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LHASA IN 1937

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I SPENT the spring and early summer of 1936, as a member of Marco Pallis' expedition, climbing and bird-watching in the neighbourhood of the Zemu glacier and Lhonak in the north of Sikkim. Towards the end of June I happened to be staying with Mr. B. J. Gould, the Political Officer of Sikkim, in his Residency at Gangtok. Ever since the famous mission of Sir Francis Younghusband to Lhasa in 1904 the Tibetan Government have occasionally invited the Political Officer of Sikkim to visit their capital. It happened that in the spring of 1936 Mr. Gould was invited to Lhasa, and he asked me if I would like to accompany him as his private secretary to help with ciphering, and to undertake survey, photographic, and natural history work. I would like to record my deep gratitude to Mr. Gould for giving me the chance of fulfilling one of my most long-cherished dreams.

I spent a very busy month taking a refresher survey course at Mussourie and collecting the necessary photographic equipment and trying to pick up the elements of the most complicated Tibetan language before we left Gangtok on the last day of July 1936. The other members of this diplomatic mission were Brigadier P. Neame, V.C., D.S.O., H. E. Richardson, I.C.S., the British Trade Agent at Gyantse, Captain W. S. Morgan, I.M.S., also stationed at Gyantse, two wireless officers from the Royal Corps of Signals, E. Y. Nepean and S. G. Dagg, and the invaluable and charming Rai Bahadur Norbhu, O.B.E., the British Trade Agent at Yatung, who acted as interpreter for the Mission and who had preceded us to Lhasa. This was therefore the largest diplomatic mission ever to visit Lhasa, and we spent practically six months there from August 1936 to February 1937.

On political matters I am not qualified to speak. I shall therefore confine myself to my own departments and to a general account of Lhasa as it is to-day, especially in so far as it has changed since the visit of Sir Charles Bell, who spent nearly a year there in 1920–21.

The thirteenth and greatest of the Dalai Lamas had died in 1933, and during our visit a Regent was in charge of affairs while the next reincarnation was being sought by a complicated system of divination. Meanwhile

the Norbhu Lingka, the summer palace of the Dalai Lamas, was open to our inspection; we were allowed to visit it and to take photographs there as often as we liked. Its grounds, half a mile to the west of the Potala and a mile to the west of the city of Lhasa, are surrounded by a high wall pierced by several ornamental gateways. Within are magnificent groves of trees and beautiful gardens. In a more private enclosure is an artificial lake surrounding a small island on which there is an exquisite pagoda where the last Dalai Lama would spend many hours each day in meditation. Scattered in the grounds are several small but attractive palaces roofed with highly glazed tiles surmounted by golden turrets. In the lake pavilion and in several rooms of the palaces were heavy silken cushions on which the Presence—as the Dalai Lama is called—would sit cross-legged in Tibetan fashion either in meditation or when engaged in affairs of state. We noticed that in nearly every such room things were prepared for the apparently imminent appearance of the next ruler. His tea cup, bell, and prayer wheel were put ready, while frequently a bowl of fruit or other food stood upon the carved wooden table before the seat. The rooms were all beautifully clean and ready for immediate occupation, though the new incarnation, when divine signs and portents have at last led to his discovery, will be only a child and will have to spend some years being most carefully taught and prepared for his office before he can come to occupy his palaces at the Norbhu Lingka.

The last Dalai Lama was extremely fond of animals and he had a small collection in the Norbhu Lingka. Though his herd of stately Mongolian camels still roam the thorny waste land between the summer palace and the Lhasa river, the rest of his menagerie seems to miss his loving care. Two *shou*, the almost extinct Sikkim stag, are still tethered on one of the lawns. A monkey is chained to a pole; some Demoiselle cranes and a pair of Monal pheasants are confined in cages; while on the pond are numbers of half-tame bar-headed geese and Brahmany ducks. But only a few remain of the fierce Tibetan mastiffs which used to inhabit the stone kennels standing at frequent intervals beside gateways and before the doors of the palaces. Roses, hollyhocks, sweet-williams, and many other familiar flowers abound; bamboos grow to a height of 20 or 30 feet; and apples and peaches bear fruit, at a height of nearly 12,000 feet above sea-level. But the lawns are now untended, the borders unweeded, and most of the annuals have seeded themselves and are forcing their way up in the cracks between the paving stones and on the granite staircases.

The most striking part of the Norbhu Lingka is the Dalai Lama's stables. Here there is room for some fifty ponies, and above every stall is an enchanting fresco in bright colours on the wall. Many are of equestrian subjects: Pegasus-like horses with scarlet wings, a man leading a pony laden with symbolic jewels, and a diagrammatic painting showing the bones and arteries of a horse. On each side of the stable entrance are two larger paintings: one the conventional sign of welcome, a Mongolian leading a tiger; and the other a work of art calling to mind an Italian primitive, a man leading an amiable-looking elephant. I was able to take both black-and-white and colour photographs of these paintings. They have a peculiar charm, and, though occasionally incorrect in perspective, exhibit a rare economy of line and colour.

The Tibetans, although they are remarkably fond of flowers, are not notable gardeners. In the summer nearly every window and verandah is adorned with pots of gay blooms, but only at the Norbhu Lingka and at the homes of the Regent, of Tsarong Shap-pe, and the Lhalu family did I see what could be described as gardens. Here there were flagged paths bordered by beds in which plants were set, often still in their pots. In this way a continuous show of flowers can be maintained, for as soon as one kind is over, another, about to flower, is put in its place. Thus the Regent's garden had for August and half September sunflowers, which grew to a height of 6 feet; from then until the middle of October coreopsis, which was 4 feet high; and finally Michaelmas daisies, which for some reason did not do well. After the middle of November the beds were manured and left empty.

There are few lawns in Lhasa. Where animals are prevented from cropping the grass it is usually plucked by hand. The city is surrounded by *lingkas* or parks, which are square walled enclosures, often as much as 100 acres in area, wherein trees are planted. In these there is usually a small summer house for picnics but no flowers of any sort. The trees are for the most part willows, which are usually pollarded every few years, and black or white poplars. The greatest variety of trees is seen in the Norbhu Lingka, but the finest individual specimens grow beside the temple of the State Oracle at Netchung, a mile from Drepung monastery. In the gardens walnuts, apricot, peach, and apple trees, bamboos, cypress, and pines are grown. The apples and peaches grown in Lhasa are undersized and lacking in sweetness, but the walnuts are large and delicious. Better fruit is imported from south-eastern Tibet.

There are a certain number of vegetable gardens in which cabbages, peas, beans, and potatoes grow excellently, also a root which is intermediate between a turnip and a radish. I saw glass frames only in Tsarong's garden. The seeds are usually forced in boxes indoors and it is here that most of the perennial plants are taken for the winter, though these are few, as nearly all the flowers are annuals grown from seeds which the gardeners collect themselves or obtain from India. The perennials I observed were a few roses, hollyhocks, chrysanthemums, carnations, phlox, and Michaelmas daisies.

All who have visited Lhasa are captivated by the enduring wonder of the Potala, the monastery-palace of the Dalai Lamas. Built, storey above storey, on the summit of a 700-foot hill that rises from the level plain it completely dominates the landscape. Its exquisite setting, in the centre of the green vale of Lhasa, surrounded by a circle of austere mountains, its phenomenal size, and the inspired restraint of its decoration, combine to make the Potala the most beautiful and impressive building of the world. It seems to have grown there rather than to have been built, so perfectly does it harmonize with its surroundings.

On the summit of the Potala are golden pagoda-like shrines covering the tombs wherein are embalmed the mortal remains of former Dalai Lamas. The tomb of the last Pontiff has only recently been completed and it is interesting to see that the work done in Lhasa to-day is apparently indistinguishable from similar work carried out at various times since the seventeenth century when the palace, in its present form, is supposed to have been built. The actual tomb runs up through several storeys of the building, and it can be

seen from the photographs of Sir Charles Bell taken in 1920 (see his 'Tibet past and present,' p. 54) that some structural alteration has been made. The part containing the tomb is a small red-washed block on the left of the central similarly coloured portion. Formerly this was white, and therefore not included in the most sacred part of the Potala.

The great depth of unbroken wall below the lowest windows is to make a platform for the building on its narrow sharp ridge of rock. Thence the even rows of small windows lead up to flat roofs sparingly ornamented with turrets. The irregular height of the different blocks of the building gives variety, and the whole is crowned with glittering pavilions on the summit. The lower walls of Tibetan buildings are of granite blocks; the upper storeys of the houses often of mud. In the dry Lhasa air, with annual rainfall of 14 inches and negligible snowfall, these mud walls last for about a hundred years.

Along the top of nearly every Tibetan roof is a broad maroon-coloured band bordered above and below by a string course of square beam ends. This is made by laying willow twigs horizontally and cutting them vertically like a half-used haystack. These osiers are stamped down with mortar which has been mixed with a reddish dye. The resulting matt surface forms an ideal background for the golden monograms and emblems which are usually placed there. This dark band can be seen right along the top of the various blocks of the Potala.

The inside of the building, compared with its superb exterior, is disappointing. It would be interesting to have an architect's report on its construction and condition. Dark passages, slippery with centuries of spillings of Tibetan buttered tea, lead with no apparent design from assembly hall to shrine, and from temple to private apartment.

The Tibetans have never learnt to construct an arch. In all their rooms a number of square poplar pillars support the heavy roof beams, which themselves uphold transverse willow poles placed a foot or 18 inches apart. In the larger halls the roof is supported by composite pillars formed by several smaller tree-trunks clamped together with iron bands. Above these transverse poles, smaller branches are laid at an angle giving a pleasant herring-bone effect. On top of these are small twigs on which is laid the flooring of the upper storey. The vertical and horizontal beams are painted red and picked out with conventional designs in gold and bright colours. The smaller roof poles are painted a bright milky blue.

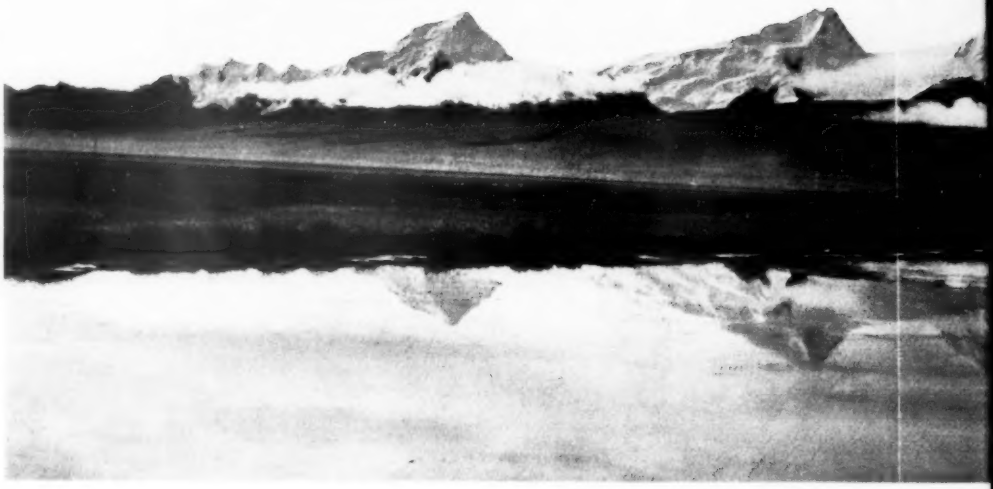
When the last Dalai Lama died, the faithful from many parts of the Buddhist world contributed what they could towards the ornamentation of the inner tomb or *chorten*, which must be about 60 feet high. The framework is of solid silver; it is covered with exquisitely worked gold leaf embellished with gifts of onyx snuff-boxes, strings of amber and pearls, turquoise head ornaments and charm boxes, pieces of lapis lazuli, amethyst, coral, and other semi-precious stones. Around the foot of the shrine are shelves whereon are displayed more precious presents: gifts from the rich monasteries of Mongolia and China, and from the ancient and noble families of Lhasa. Here are chalice-like golden vessels, heavy silver bowls and butter lamps, marvellous examples of cloisonné, rare porcelains and vases, meticulously wrought metal work, and curiously fashioned china plants in glass cases. Against one wall are

Frescoes over the stalls in the Dalai Lama's stables

Conventional painting of a Mongolian leading a tiger, signifying welcome

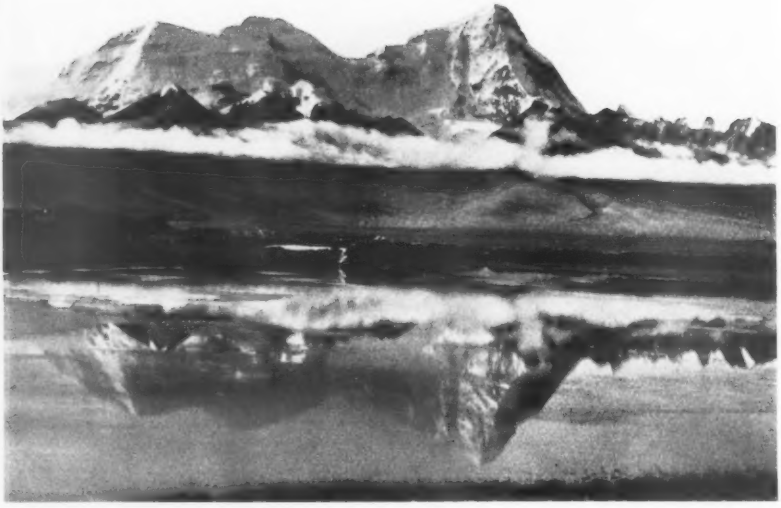
Tsarong

Three ladies of high rank, with Tsarong's wife in the centre



Panorama of the Chomolhari range from Tuna, with Cho

The vale of Lhasa, showing the Potala and, to its right, Lhasa city. At the foot of the mountai Hill, and immediately behind it Kundeling monastery. The Norbhu Lingka lies to the extreme left



:ith Chomolhari on the extreme right

mountains (centre) is Sera monastery. To the left of the Potala is the Iron eme left

images of different Buddhas, and holy books set in carved alcoves, and in front of the tomb are immense silver butter lamps always burning to the memory of the saintly ruler.

All visitors to Lhasa come to pay their respects to this shrine, and many Tibetans make long pilgrimages for this especial purpose. It was probably on account of this that there were an unusual number of nomads in Lhasa during the winter months. These swarthy independent-looking people come down from Amdo, Golok, the high desolate Chang Tang, and the far Mongolian border. Many of them bring herds of yaks and sheep with them, carrying loads of wool, salt (which they collect from the shores of the great brackish lakes), and yak dung. A part of this curiously assorted merchandise is paid as their year's taxation at the Potala. The rest is exchanged for *tsamba* (parched barley meal) which they are unable to grow up on the arid wind-bitten plateau where they live.

Groups of these attractive-looking people would be seen in the early morning making the prescribed holy walk around the precincts of the city. They turned their prayer wheels as they walked, while their lips moved with continuous repetitions of the holy formula.

Little is known about these magnificent people. Had one the requisite knowledge one could tell by examining the clothes and the curious head-ornaments of the women from what far corner of high Central Asia the family had come. One woman had her hair tied into innumerable small plaits sewn on to the top of a long strip of scarlet and green chequered cloth which hung almost to the ground. The squares of this were ornamented with Chinese dollars, cowrie shells, rows of trouser buttons, and fragments of agate and turquoise. Another wore over her forehead a disc as large as a saucer made from concentric rows of coral and turquoise, while her hair was divided into two series of plaits which were looped at each side to her belt. Over her nape hung a square of cloth ornamented with ivory and bone objects.

These nomads are noted bandits when occasion offers; and it was interesting to see how diffident and shy they seemed in the presence of the sophisticated and self-assured townsmen. It would be fascinating to return with them to their homes, often many months' journey to the north of Lhasa, and to find out more about the generations of self dependence and fortitude that have gone to the making of these proud sunburnt men with a faraway look in their eyes. But the language problem would be difficult: though they could understand my halting Lhasa Tibetan, and were vastly amused thereby, I could make nothing of their sing-song vernacular and even our Tibetan servants found them almost impossible to understand.

During our stay the young Regent was the highest official in Lhasa. One of the incarnate lamas in charge of the six small but important monasteries in the vicinity of Lhasa is usually elected to fill this office; but the present Regent was chosen by the late Dalai Lama shortly before his death. He was the only Lhasa official who was too great to be permitted to visit the small house between the Potala and the Norbhu Lingka which had been lent to us by the Abbot of the nearby Kundeling monastery. The young Prime Minister, the four Cabinet Ministers, the four Grand Secretaries corresponding to a Lama Cabinet, the monk and lay Commanders-in-Chief, the Abbots of Drepung

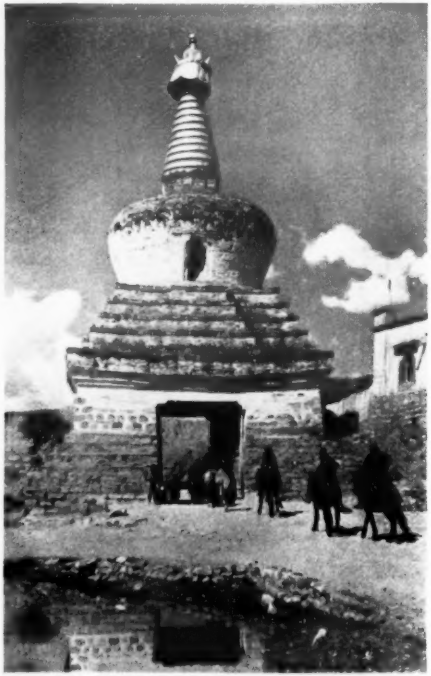
and Sera monasteries, and even the State Oracle from Netchung all came to pay their respects and to present white silk scarves of greeting.

One of our most arduous tasks as members of a Diplomatic Mission was to eat formidable lunches with each of these ministers in turn. Preceded and followed by gaily dressed mounted servants, we would leave our house at about eleven o'clock and ride to our host's residence, which might be in a park-like enclosure on the outskirts of the city, or perhaps opening off some squalid back street where we would have to splash through flood-water and filth.

Having reached our host's front door, which would be of exquisitely carved woodwork painted in bright colours, we would ride into a cobbled courtyard, often of great size. Here would usually be mules or yaks laden with bales of coarse wool, the real wealth of Tibet, ready to be sent down to Kalimpong from where it would eventually be shipped, curiously enough, to America to be made into carpets. Servants dressed in long robes of indigo-coloured home-spun cloth would steady our ponies while we dismounted on to granite blocks ornamented with carved swastikas placed on either side of the entrance door. The lower storey rooms are given up to granaries, store-houses, and the offices of stewards and senior servants. We would then climb a rickety wooden ladder to the first storey; it is curious that the Tibetans, such marvellous external architects, have never learned to build stair-cases inside their houses. Our host would usually come down to meet us, and after exchanging scarves with him we would go into the main sitting-room for a preliminary meal of tea, dried fruits, sweets, and biscuits. Later on the main meal would be brought in: to begin with many small dishes of boiled mutton, yak tongues, preserved prawns, dried fruits, and always small nuts and sunflower seeds. Then these *hors d'oeuvre* dishes would be put to one side and a series of large china bowls of steaming savoury courses would succeed each other. There would be sea slugs, sharks' fins, mushrooms, bamboo roots, meat balls, stuffed eggs, and many other delicious and highly spiced dishes. We would always eat with chopsticks, which in any case are difficult to manipulate, and especially so when dealing with such slippery things as sea slugs and sharks' stomachs. *Chang*, a local barley beer, would always be served by attractive "chang girls" who force reluctant guests to drink as much as, or preferably more than, they can manage. The Tibetans have the most charming natural manners, and they are excellent if exacting hosts. It would often be four or five in the afternoon before we were allowed to return from these banquets.

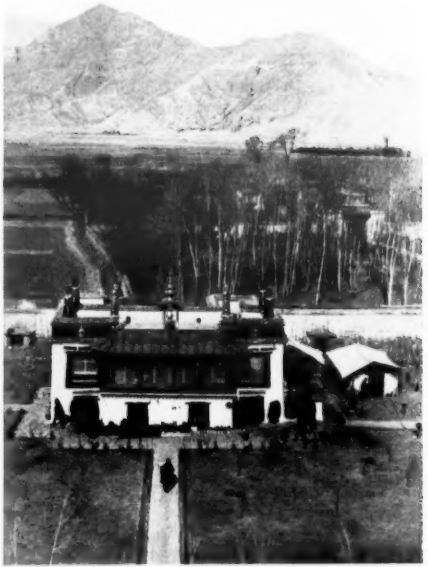
The Tibetan living-rooms are extremely decorative and comfortable, though we often found them rather cold, as it is their custom to put on an additional silken fur-lined robe rather than to warm the room. Although glass has to be carried on the backs of pack animals from Kalimpong or Gangtok, it is gradually replacing the Tibetan windows of ornamental trellis work covered with oiled canvas.

A few signs of Western influence would appear in the houses. There might be framed portraits of Political Officers who had formerly visited Lhasa, and such things as gramophones and silver tea sets, usually gifts from these visitors. But it was rare to see their own characteristic and beautiful scheme



Pierced chorten forming the western gate of Lhasa

A street in Lhasa with the Potala in the background; on the left is a prayer pole



The Regent's summer palace

Yaks threshing corn

Flailing barley

Nomad sewing a bag of salt, carried on the back of a sheep

of decoration upset by the juxtaposition of some tawdry representative of an alien civilization.

Prior to our visit the only wireless transmission set in Lhasa was one in the possession of a Chinese who, together with the apparatus, was left in Lhasa after General Huang Ma Sung's mission of 1932. We presented portable reception sets to several of the officials.

There is no cinema there, though our 16-millimetre projector provided a most popular series of entertainments. Films of themselves, especially in colour, proved most popular, closely followed by Charlie Chaplin's early successes, one of the Jubilee procession, and a Rin-tin-tin film called "The night cry."

The Lhasa postal and telegraph system is most efficient. It is in charge of a Tibetan monk who was trained at Kalimpong and who speaks adequate English. The line was laid from Kalimpong over the Jelep La as far as Gyantse by the 1904 Mission. In 1921–22 it was continued to Lhasa. It is maintained by Nepalese line-men, with occasional visits—as far as Gyantse—from English engineers. The muleteers sometimes take the posts for firewood and amuse themselves by throwing stones at the insulators, but during our visit we were always able to telegraph messages to India. The Potala is connected by telephone with the Post Office.

Stamps, in five values and colours, are printed at the Lhasa mint; they are current only within Tibet. Post-runners carry the mails to Gangtok (our letters were re-stamped at Gyantse). Running from dawn to dusk in relays of about 8 miles they covered the 330 miles from Lhasa to Gangtok in from eight to ten days.

Several of the larger houses and official buildings of Lhasa are lit by electric light instead of by the traditional lamp of a wick burning in a bowl of mustard oil or yak butter. The origin of this anachronistic streak of our civilization is a strange story. The Dalai Lama, inspired by Sir Charles Bell, decided to augment their Tibetan education by sending four boys to school in England, where they spent several years at Rugby. These were trained as a soldier, a surveyor, a mineralogist, and an electrical engineer. Ringang, who installed the hydro-electric plant at Lhasa, after three years at Rugby, had spent a further three years at an engineering college in England. Not only is he in charge of this installation and of the mechanical side of the state mint, but he is the interpreter to the Kashag or Cabinet, a district magistrate, and a municipal officer; he still speaks the most perfect and idiomatic English. Although he was too busy to spend very much time with us we found him a most entertaining and intelligent man. Gonkar, the soldier, died soon after he returned to his native land. Möndö, the monk, was trained as a mining engineer, but as his activities were alleged to have disturbed the local spirits and ruined the crops, he fell into disfavour, and spent several years as a magistrate of a remote and unimportant village. He is now a prosperous Monk Official with an office (the Tibetan word literally means "nest of papers") at the Potala. Kyipup has given up surveying and is now a city magistrate and in charge of the company of Lhasa police. As an educated man in Lhasa is one who can write perfectly the complicated Tibetan script, the Rugbeians, after so long an absence from home, seemed to be uneducated.

Now their natural merit or the advantage of their education in England has asserted itself, and they are all three in potentially important positions. They are all primarily Tibetans, whatever Western knowledge they may have acquired.

Perhaps the most interesting personality in Lhasa to-day is Tsarong, a man who was at one time Commander-in-Chief of the Army and a Cabinet Minister, but who now has no official position. He represents a rare thing in Tibet—a layman, not of noble birth (his father was one of the Dalai Lama's archers) who, by his own efforts and merit, has risen to high position. Normally the lay officials are selected from a few ancient and noble families; only in the monasteries do all men stand a reasonably equal chance of preferment. Tsarong has built himself a fine house on the outskirts of Lhasa and his family is as delightful as one could meet in any part of the world.

Although this house had glass windows, a stone staircase, electric light, and a bathroom, it is yet typically Tibetan in detail. The finest room in the house is the altar room devoted to the worship of Buddha. Along one wall of the room are huge gilt images of different deities adorned with jewelled diadems and necklaces of solid amber. In front of these are holy water vessels and curious symbolic images made of butter and *tsamba* mixed into a paste and dyed different colours. There are also silver *chang* pots, porcelain vases and, oddly enough, a terrestrial globe. The floor of the room is of small pebbles and earth beaten down and polished to the consistency and appearance of marble by the continual passage of servants' padded footwear. The walls are ornamented with *tankas*—paintings on fine canvas of some religious subject framed in heavy silk brocade cut from the dress of the departed person for the benefit of whose soul the *tanka* is made. These paintings, often of great size, are of rare beauty though the subjects, to our eyes, are often macabre. The richness, contrast, and depth of colouring is only surpassed by similar frescoes on the walls of Drepung, Sera, and other great monasteries near Lhasa.

At one time it seemed possible that we might go up beyond Lhasa, perhaps as far as Jyekundo, some 500 miles to the north-east of Lhasa. This would have involved crossing the headwaters of the Salween and Mekong rivers and a considerable amount of little-mapped country. If it could have been done without offending susceptibilities I had hoped to carry out some survey work. As we did not go beyond Lhasa the instruments were not even unpacked.

Daily meteorological observations were taken during our stay, including the maximum and minimum temperature and the barometric pressure each day, together with notes on the force and direction of the wind, cloud formations, etc. There were only two falls of snow during our visit, and no rain after September. During the afternoons of parts of December and January dust storms would blow from the west with almost monotonous regularity.

Notes were made on the distribution of plants, birds, and animals. Some five hundred species of plants were collected for the herbarium at Kew, and are being identified. Seeds were also collected. As both Richardson and I were very interested in birds we were able to make very valuable observations, which with the botanical notes will later be published in the appropriate journals.

On the journey to and from Lhasa we passed close beneath the exquisite sentinel peak of Chomolhari (24,000 feet), and I resolved to attempt its ascent.[1]

Having been fortunate enough to obtain permission from the Tibetan and Bhutanese authorities, I reached Phari on 12 May 1937, accompanied by C. E. Crawford, of I.C.I., Calcutta, and three Sherpa porters. Enlisting six local men to carry loads we crossed the Sur La into Bhutan, and, as the existing map is only an approximation, spent several days working our way over rocky cols and across deep valleys clothed in pine and juniper forest before we could reach the long southern ridge merging into the snow and ice arête, which seemed to afford the only possible approach to the summit.

After sending back our Phari men the five of us camped on May 16 at 18,500 feet on some névé at the foot of the Giant's Fang, an 80-foot pinnacle of rock which breaks the ridge at the point where the ice starts. Two days later, after many vicissitudes, we had traversed the mile-long lower part of the arête and camped at 20,000 feet some way up the steeper final cone of the mountain. One porter had been left behind at the last camp; now the party was forced to divide again. Crawford, whose leave had almost expired, and one porter, returned; while Passang, the only fit survivor of the Sherpas, came on with me. On May 20 we crossed a formidable ice-fall, and after being held motionless on an uncomfortably steep slope for two hours by a blizzard and thunderstorm, we excavated a platform for our bivouac tent at 21,500 feet. Next day, after eight hours of straightforward kicking and cutting of steps, we reached the summit of Chomolhari and were rewarded with a superb view over the cloud-chequered Phari plain to Everest, Makalu, and all the major peaks of Sikkim.

Our descent started unpropitiously, as a sudden slip resulted in an unpremeditated slide of several hundred feet. We returned to our bivouac camp and attempted to get below the ice-fall, but were stopped by another blizzard. It took us four days to get off the mountain, as knee-deep soft snow and vile visibility daily impeded our progress. On almost every day that we were on Chomolhari it would cloud over between nine and twelve in the morning, and the visibility would be reduced to a few yards owing to falling snow and the lack of any dark object on which to focus the eyes. As crevasses abounded we were thus forced to camp each day after a few hours' advance.

Various fortuitous circumstances added to the discomfort of our descent. Passang was suffering from snow-blindness, having broken his glasses, and, having climbed brilliantly on the ascent, was now virtually a passenger. Our clothes and sleeping-bags became wringing wet owing to absorption of snow melted by the fierce sun; even the matches in my inner pockets disintegrated so that we could not use the primus for warmth or cooking. The zip fastener on the tent opening jammed so that snow continuously blew inside. On one occasion, owing to clumsy handling of the rope as I jumped, I fell 30 feet down a crevasse which was so wide that the only possible way of egress was to cut steps and handholds up one wall. But the clogging new snow and bad visibility were our most formidable and persistent enemies.

[1] A fuller account of the climb was published in the *Alpine Journal* for November 1937, and in the *Himalayan Journal* for 1938.

It was May 26 before we returned to Phari after an exhausting 20-mile walk from the foot of our ridge.

DISCUSSION

Before the paper the PRESIDENT (Professor HENRY BALFOUR) said: Mr. Spencer Chapman spent many months in Lhasa in 1936–37, and is going to give us an account of the city and its surroundings. He is also going to add to his lecture an account of his remarkable ascent of Chomolhari. I have no doubt that some of you have read the preliminary accounts of that expedition and will be anxious to hear directly from him something of his achievement. Mr. Chapman not only has a good deal to tell us, but also has a considerable number of slides and some films to show, and I call upon him at once to speak to us.

Mr. Chapman then read his paper, and a discussion followed.

The PRESIDENT: It seems to me really but a few years ago—just at the beginning of this century—that Lhasa was still a "forbidden city." As we have with us this evening one who played the star turn in the unveiling of Lhasa, I think you will be glad to hear some remarks from him: Sir Francis Younghusband.

Sir FRANCIS YOUNGHUSBAND: What I liked especially in the wonderful slides we have seen this evening was the revelation they gave of the culture, the artistic ability, and the good manners of the Tibetans. When we went to Lhasa the great fear of the Tibetans was that we would "spoil their religion," as they expressed it; and this I take it included their whole culture, because in Tibet the entire life of the people, their art, their politics, and everything else is ruled by religion. When, chiefly through the great abilities of Sir Frederick O'Connor, we were able to break down that idea, they suddenly gave way and were ready to agree to anything in the way of a treaty. They did not trouble much about the treaty once they had made up their minds that we were not going to spoil their religion.

I would like to thank the lecturer for the most delightful lecture he has given us and for having brought back such wonderful films and slides. They have given us an idea of this magnificent country and afforded a real revelation of the inner life of Tibet. I am sure we were all much thrilled by Mr. Chapman's account of the ascent, and more particularly the descent, of Chomolhari, which we saw for three months exactly opposite our tent.

Sir FREDERICK O'CONNOR: I certainly did not expect that in one day in London I should spend an afternoon at the Central Asian Society looking at moving pictures of Lhasa taken by a lady and gentlemen who have just returned from that city, and that in the evening at the Royal Geographical Society I should be looking at still and moving pictures taken by a young gentleman who had also returned quite recently. I do not think that any here ever expected to meet a young man who would tell us about a visit to Lhasa as a sort of *hors-d'oeuvre* and finish up with an account of a single-handed ascent of one of the highest, and most difficult mountains in the world as the sweet. It was a wonderful performance.

I should like to refer to one or two recollections aroused by the pictures. First, the young man named Norbhu, now a prominent official on the staff of the British agent in those parts. When we went out there one of the first things Sir Francis Younghusband drew attention to was the fact that, although we had been on the frontier for a number of years, there was only one interpreter on the whole of that frontier. It was necessary when I was left behind there to try to train two or three young men to speak both English and Tibetan. I asked

a schoolmaster at Darjeeling school to send me one or two promising boys, one of whom was Norbhu, thirteen years old at the time. He has remained on the staff ever since and has been a most useful helper in every way. He is now actually in Lhasa supporting our policy there in every respect.

Another picture which brought a recollection to my mind was that of the beggars. Tibet is full of beggars, some professional and some amateur. As a mark of gratification when we had signed the treaty Sir Francis said he would give a present of a *tankha*, a small coin worth 4*d*. or 5*d*., to all the beggars in Lhasa. On the appointed day—we thought there would be about a couple of thousand of them—we, to our amazement, saw the whole plain black with beggars. There were about 11,000, and we had to draw the line somehow. We put a few people on the edge of the crowd, and any beggar who rode up on a caparisoned horse was turned back and not given a present!

The PRESIDENT: We have listened to remarks from two of the pioneers in the opening up of Lhasa. I now call upon one who has recently been in Lhasa and is, in fact, the most up to date of those who have been there. It is fortunate that Mr. Suydam Cutting is with us to-day.

Mr. C. SUYDAM CUTTING: When listening to Mr. Spencer Chapman's lecture I felt how much valuable information we are now obtaining in connection with Tibet. There certainly is a tremendous lure about Tibet, especially in the United States, and probably because people there are suddenly beginning to realize something about it that is true. It is no longer a land of the occult, the unknown, and the mystic. We are now getting into Tibet and learning something about the people and the country, and we are all particularly grateful for information such as we have had this evening.

The PRESIDENT: I do not think there is any doubt whatever as to our having had an intensely enjoyable and most instructive evening. You have shown your appreciation throughout the lecture by your applause and also by extremely hearty laughter. I find it difficult to define exactly what has pleased me most: the extreme ease with which Mr. Chapman has delivered the lecture, or the humour with which it has been punctuated, or the excellence of the pictures he has shown. No doubt many of you were prepared for a selection of admirable pictures of Tibet, because you probably saw the coloured films exhibited not long ago by Mr. Gould. Those were also taken by Mr. Chapman, and they do him every credit as a photographer.

There is one hope in my mind, and that is that some day Mr. Chapman will be tempted to return to Tibet to explore that northern region to which he referred. It is very little known, and certainly the people in that northern area should prove of great interest if they could be studied intensively. And if Mr. Chapman will only bring back a further selection of splendid photographs, his journey, which I sincerely hope may materialize, will be well worth while. After all, the pictures which we have enjoyed to-night will be a valuable record for all time, preserving a graphic record of the region in the most perfect manner, and preserving it when contact with exotic cultures will have brought notable changes. I know you will all wish to thank Mr. Chapman very heartily for the most delectable evening he has given us.

NOTES ON THE SCIENTIFIC WORK OF THE BRITISH GRAHAM LAND EXPEDITION, 1934–37

REV. W. L. S. FLEMING, A. STEPHENSON, B. B. ROBERTS, AND G. C. L. BERTRAM

Afternoon Meeting of the Society, 6 December 1937

IT is too early at the present time to give any true picture, apart from maps, of the scientific results of the expedition. The following short accounts, prepared by those responsible, are only notes, from the broadly geographical point of view, on some aspects of the work that the circumstances of the expedition allowed. In addition, some indication is provided as to the lines along which their interpretation is likely to be most significant. Any views at present expressed are liable to modification when the detailed analysis of the observations is complete.

Although the authors of these papers were each responsible for particular aspects of the work, they helped one another whenever possible, both practically and with suggestions.

A narrative of the expedition, together with maps, has already appeared in the *Journal* for April and May 1938.

GEOLOGY AND GLACIOLOGY: W. L. S. FLEMING

These notes have been written with the aim of describing briefly some of the more interesting facts which were obtained. They do not cover all the branches of the work, and only in one or two instances are suggestions made as to the probable explanation or origin of the facts mentioned.

In that part of the Graham Land region which the expedition explored, a large number of rock outcrops are exposed in summer time, but the majority of these are difficult of access. The geological work was thus mainly confined to such places on the coast where outcrops could be reached from the shore, and to the numerous small islands off the coast. Only a few specimens were collected from the interior, most of these being obtained by the sledge party which crossed Graham Land in lat. 69° S. Despite the difficulties of gaining access to exposures, and the fact that the expedition was confined to its base for the greater part of the first year, the geological work provides a fairly comprehensive view of much of the territory covered by the survey. No such work had previously been done throughout the greater part of this region, but some of the more northerly localities had been visited by the geologists of the expeditions led by de Gerlache and Charcot.

With the exception of a large part of Alexander I Land, the region covered by the survey consists of igneous or metamorphic types. The petrological study of the specimens collected has not yet been made, but from the field work it is safe to say that the homology between the Andean Cordillera (including the Archipelago of Tierra del Fuego) and Graham Land applies to South as well as to North Graham Land, as is indicated by a general similarity of petrological facies.

These rocks may be divided into three main groups.

1. A basement complex of gneisses and schists which, at the Debenham Islands, have the structure of gently dipping folds with their axes oriented north and south. This group is best exposed in the immediate neighbourhood of Neny Fjord, but pebbles of these metamorphic types are to be found in many of the beaches and some of the moraines in the northern part of Marguerite Bay.

2. Plutonic intrusions ranging from basic to acid. Granites and granoderites are the most abundant types and occupy a large area of the west Graham Land coast.

3. Volcanic and pyroclastic rocks of varied composition. Andesites, dacites, tuffs and volcanic breccias are common.

There are in addition several types of hypabyssal intrusions.

The eastern coast of Alexander I Land (with the possible exception of the northern part) is in marked contrast to the above. Here stratified sediments are well exposed in the rock cliffs on the western shore of King George VI Sound. There was time to visit only two localities along this shore, one in lat. 71° 15′ S. and the other in lat. 70° 45′ S., but the stratified cliffs were clearly seen to extend as far south as lat. 72° S. At the outcrops which were studied, the formation consists mainly of limestones, calcareous grits and shales. Over sixty invertebrate and plant fossils were collected, but with one or two exceptions they are too fragmentary and badly preserved to be identified. Some of the plant remains can be closely matched with fossil plants described and figured by Halle from the middle Jurassic of Hope Bay near the northern end of Graham Land, and the matrix at both places is similar. The invertebrates consist of lamellibranchs, brachiopods, and belemnites, and there is also one specimen bearing the teeth of a species of Hybodus.

North of lat. 68° S., the interior of Graham Land consists of a high plateau, the western edge of which lies close to the coast and is deeply dissected by glaciers. Farther south the plateau decreases in height, and south of the Wordie Shelf-ice the land slopes gradually westwards towards the sea and scattered mountain groups rise above the general level. There are many groups of small islands, rocks, and reefs off the west coast of Graham Land, and several large islands which are separated from the mainland by deep sounds with a trend parallel to the axis of the Graham Land arc. King George VI Sound is by far the largest and most striking of these features, and this sound, separating the dissimilar formations of Alexander I Land from Graham Land, is one of the most significant elements in the orography. Several depressions run transversely across Graham Land from east to west, and the existence of these accounts for some of the features which Wilkins incorrectly interpreted as straits linking the Bellingshausen and Weddell seas.

The glacial dissection of Graham Land differs markedly from that of Alexander I Land, as is to be expected from the contrasted formations on which glacial erosion has been operative. In the former case it is significant that the glaciers which drain the inland plateau follow, in their middle reaches, a direction parallel to the coast before they swing westwards towards the sea.

The mountain range in Alexander I Land which fronts the northern part of King George VI Sound is of a character seen nowhere else. The range is dominated by a steep razor-back ridge, the eastern face of which is scalloped into a series of high corries. To the east of these and at a lower level are irregular foothills of a more massive character. This range was seen at a distance, but geomorphologically it is quite distinct and it probably does not consist of the same sedimentary formation as is found farther south.

North of Marin Darbel Bay the west coast of Graham Land is deeply embayed. Only at some of the headlands do the mountain slopes come down to the sea. Elsewhere there lies, between the foot of the mountains and the shore, a narrow belt of fringing glaciers with cliffed fronts resting on rock at sea-level. These rock platforms have analogies with the strand flats of the north. South of Matha Strait, especially in the fjords and islands of the northern part of Marguerite Bay, the fringing belt of glacier-ice is almost always absent along shores that face north or west. There are indeed small valley glaciers on these "sun-exposed" slopes, but between the snouts of the glaciers there are ice-free shores—and here are exposed in summer time a series of raised beaches in well-defined terraces up to twelve in number, with the highest at an elevation of 70 feet above present sea-level. These beaches form a relatively narrow belt between the mountain foot and the sea, and in many places they are partially obscured by screes.

A much greater proportion of the shoreline in the north Marguerite Bay region is free from ice than is the case farther north, and in that same region the ice has in places receded recently from divides over 1000 feet in height to expose debris-strewn glacially moulded terrains. There are other lines of evidence which indicate a former more extensive and widespread glacierization. Thus in the Argentine Islands and many of the neighbouring islands glacial striae and polished grooves may be seen, whilst moraines and erratics occur on ground from which the ice has receded. Some of the valley glaciers in the Marguerite Bay region have been so depleted that now they are stagnant, and the slowly wasting ice is covered by moraines and scree debris.

In connection with the glacial recession, the existence of the characteristic fringing belt of glacier-ice between the mountains and the shore is of special interest. These glaciers are short in the direction of flow and form a narrow bench of ice which terminates in cliffs ranging between 200 feet and 15 feet, but more generally varying between 60 feet and 90 feet in height. The thickness of the ice exposed in the terminal cliffs bears little relation to the width of the ice cover. Where the glaciers are short in the direction of flow, the ice thickness is quite out of accord with the present small gathering ground, the short distance in direction of ice flow, and the small surface gradient of the glaciers. These fringing glaciers lie beneath the present snow-line and are clearly features inherited from a period when the bays and islands off the west coast of Graham Land were filled with shelf-ice with which the fringing glaciers merged. In a few specially protected places relics of the once extensive shelf-ice are to be found, namely: a small sheet of shelf-ice at the head of the southern arm of Beascochea Bay; a triangular wedge of shelf-ice at the north-eastern corner of Adelaide Island; the Wordie Shelf-ice filling the

south-eastern part of Marguerite Bay, which actually merges laterally with the fringing glacier of Cape Berteaux without discordance; and the shelf-ice locked in King George VI Sound.

Almost all the smaller islands north of Adelaide Island are covered wholly or in part by ice, the thickness and configuration of which is also out of accord with the present climate. Some islands only a few acres in area are entirely covered by a thick ice mantle terminating in ice-cliffs over 140 feet thick which rest on rock at sea-level. Many of the island ice-caps are asymmetric, having been modified by differential thaw (dependent on exposure to the sun) and by the prevailing and dominant north and north-easterly winds. Thus the ice-hills of the Argentine Islands are typically of a whaleback form. In each case the surface of the ice rises in a gradual slope from the north to a gently domed summit situated near the southern end of the island. Along the south shore the cap of ice is truncated by ice-cliffs, undermined in places by caves. The initiation of the island ice-caps, to whatever extent they may have been modified by subsequent agencies, is to be ascribed to a period when they coalesced with surrounding shelf-ice.

Of all the glacial features in this region, perhaps the greatest interest attaches to the shelf-ice filling King George VI Sound.

The shelf-ice is over 200 miles long and on an average 15 miles in width. At its southern end it merges with a wide bay opening towards the west, which is also assumed to be filled with shelf-ice. At its northern end the shelf-ice discharges normal tabular bergs. For some miles farther south it is broken by rifts, which are floored by sea-ice. South of the rifted zone the surface of the shelf-ice rises at a gradient so gradual as to be scarcely perceptible, except in a constricted part of the Sound around lat. 71° 45′ S. where there is a distinct increase of slope. At lat. 72° S. the southern sledge party's most southerly camp on the shelf-ice was estimated as at least 500 feet above sea-level. On either border of the shelf-ice there is a sharp and well-defined change of gradient, where the ice descending from the land to the Sound spills over a steep slope and gives a distinct appearance of a shore-line. This fact, together with the absence of any features to suggest a passage from shelf-ice to land-ice as one travels south down the Sound, and the exposure in lat. 70° 45′ S. of a normal tide crack on the western side of the Sound, leads to the conclusion that the shelf-ice is afloat throughout its entire length. For lack of any certain evidence, such as some form of seismic sounding experiments might provide, the burden of proof rests with those who would claim that the ice in the Sound is aground.

Among the features of glaciological interest in the Sound, the following five may be mentioned:

Pressure phenomena on either side of the shelf-ice as far south as, but not beyond, lat. 70° 48′ S. At the headlands north and south of Ablation Bay in lat. 70° 45′ S. the pressure ridges are disposed as a series of parallel ridges which in places rise 100 feet above the general level of the ice. Ablation Bay is itself filled with a mosaic of pressure mounds separated from one another by lanes of clear fresh-water ice.

Stonehenge ice: this name is applied to the occurrence of stacked and

uptilted blocks of pressure-ice formed along the troughs of certain pressure rolls parallel to the shore.

Ice calderas: around lat. 70° 45′ S. there are in the Sound several oblong or circular bowl-shaped basins in the shelf-ice up to 1 mile in diameter with cliffed borders up to 100 feet in depth. In the bottom of these depressions are mounds formed of angular blocks of ice piled to a height of 30 or 40 feet above the general level of the floor, and between these the basins are paved with mounds a few yards in diameter, each consisting of slabs of radially cracked ice tilted upwards to meet in a point. The name "ice caldera" is used for basins of this type, as they are not unlike miniatures in ice of centrally collapsed volcanic calderas. The resemblance applies also to the cliffed borders from the top of which the surface slopes radially outwards and downwards to merge with the general level of the shelf-ice. The ice calderas are quite isolated and bear no apparent relation to the point of entry of glaciers flowing in to the shelf-ice from either side of the Sound, and there are no pressure phenomena outside the area of the ice calderas which might throw light on their origin.

Ablation phenomena: in and around Ablation Bay, in lat. 70° 45′ S., ablation has dissipated all the superficial snow and névé to expose hard ice and lower its level. Ablation is responsible for the exposure along the shores of the bay of a tide crack to which reference has already been made. The valleys entering the Sound in this neighbourhood from Alexander I Land are in many cases glaciated valleys now practically destitute of ice. The ablation is largely ascribed to detritus from the land distributed over the ice by the wind.

The gently convex form of the shelf-ice in transverse section.

A glacial diary was kept at the base to record snowfall, surface ablation, the character of the snow surface, drifting, sea-ice conditions, and other relevant details. During the first winter and spring detailed readings were made of the rate of growth and decay of the sea-ice above and below the original ice surface. Samples were collected from different depths in the ice with the aim of finding the variation in salinity and detecting any change in the proportion of sulphates to chlorides. The records made at the base of the general character and distribution of the sea-ice during its growth and dissipation were supplemented for a wider area by information obtained from flights and from the *Penola's* voyages, thus enabling seasonal ice-maps to be made. The absence of old pack-ice off the west coast of Graham Land is noticeable. The time of break out of the sea-ice is thus dependent on its rate of dissipation *in situ*, and on winds, swell, and currents.

It is remarkable that bergs are almost wholly restricted to a zone within a few miles of the coast. The character and distribution of the bergs throughout the various seasons of the year were recorded with the aim of tracing their movements and estimating their rate of decay. In Penola and Lemaire Straits there is a marked northerly drift, but in the north-east part of Marguerite Bay most of the bergs waste away near where they were originally calved. It is believed that bergs are being discharged from floating glacier tongues at a rate in excess of the forward movement of the ice: in other words, that these tongues are receding.

SURVEY: A. STEPHENSON

On leaving England our main object, as far as survey was concerned, was to make an exploratory survey of the continental edge between the southern end of Graham Land and the edge of the Falkland Islands Dependencies on the west, and as much as possible of the shore-line of the Weddell Sea, just east of Graham Land. If we were not to use climbing parties who would climb high peaks inland from the shore-line, such a survey as we contemplated would have to be based on a series of fixed points in a long line, rather than a belt of points forming a narrow triangulation. The best way, if not the only way in this type of country, to get a continuous and accurate measurement of such a line of points is the "Short Base method" as used by Spender in the Danish East Greenland Survey. This method was discussed with Spender in Copenhagen before we left, and we were prepared to use it in part if not altogether, should the country prove suitable. One major limitation to this method, where we were concerned, was the fact that ours was a small expedition in which every man had his own specialized work to do, and there were no natives or spare people to carry instruments and build cairns. The building of substantial cairns that can be clearly seen is essential in the Short Base method. Generally speaking, a survey party on this expedition was limited to two people, although a third was essential in summer in order to look after the motor boat, since it was inadvisable to leave the boat unattended owing to the heavy swell in these regions. It was obviously impossible therefore to carry out the detailed Short Base method, in which the gear required at each station amounts to four "man loads."

On arriving in Graham Land however it soon became apparent that a continuous survey by the Short Base method or any other quick method was going to be impracticable in the summer time. The general topography of the coast was much what we expected, namely, a series of glaciers and rocky promontories; but there was present in addition one feature which made a landing impossible for mile after mile. This was a narrow belt of ice, looking much like glacier ice, which fringed all the rock promontories. The valley glaciers themselves finished in ice-cliffs that were continually calving, and at the edge of the glaciers the moving ice merged into the land-fast ice that encircled the rock walls, and continued unbroken round the point to the next valley glacier. These belts of ice, though often less than 100 feet broad, were crevassed and had ice-cliffs 15 to 20 feet high, which calved periodically. The rock wall usually rose straight up from the ice, and even if an ascent on to the ice could have been made, further progress inland would have been impossible. There were isolated places where one could land, but these were either very low beneath a vertical cliff or in bad positions for survey purposes.

It seemed apparent then that the survey of the coast would have to be done from off-shore. There were numerous islands scattered off the coast and we hoped to join these up with a triangulation from which we could fix points on the coast. It was with this in view that we made a triangulation of the Argentine Islands, a line of islands running west from our base for about 10 miles, and from this east–west line we hoped to continue the survey of the islands to the south. These islands to the south however proved to be

more than a day's distance away from the base, and owing to our ignorance of what harbours existed there, we were obliged to limit our survey to those places which we could reach in one day's travel.

The final methods adopted in the main coastal surveys were much the same both in the first and second year, although the time at our disposal influenced the amount of detail included. Generally speaking, rapid measurement of continuous distances at all accurately, either in a straight line or by triangulation, was impossible. Therefore we aimed at fixing astronomical points at about every 30 miles, and doing as many azimuth observations as we could. From these theodolite stations horizontal and vertical angles were taken to prominent features, hoping that some of them would be visible from the next station. The intervening detail between these stations was put in by plane-table if we had time, as in the first year, or by compass bearings taken from points fixed by dead-reckoning from the sledge wheel. When using a theodolite for horizontal angles, readings were taken on one micrometer only, as they were to be used for plotting rays on paper rather than for triangulation. The stations from which these angles were taken were never very accurately fixed, and it was to no purpose therefore to waste time in measuring angles to seconds. Vertical angles were taken more accurately as we were usually working from sea-level, and generally speaking the high peaks to which we took vertical angles were fixed by a number of rays, making their position more accurate than some of the lower detail to which we could only get a few badly intersecting rays.

To generalize therefore, our method of survey was to run a single-line traverse based on compass and sledge wheel, with astronomically determined check points every 30 miles or so, the detail on either side of the line of traverse being put in by intersection either by plane-table, theodolite angles, or by compass bearings.

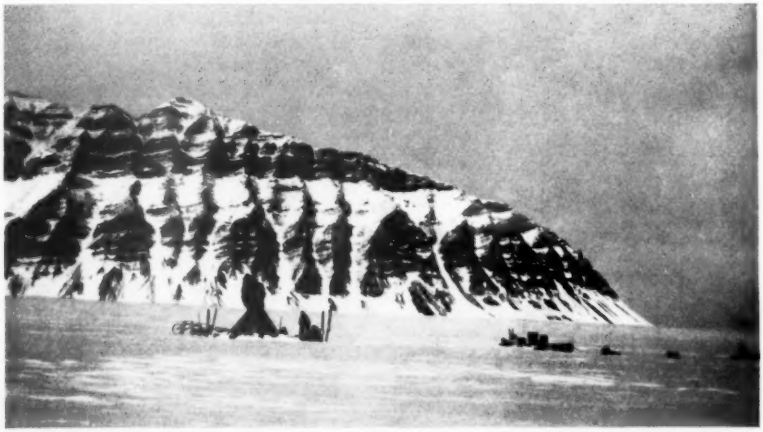
In order to give any breadth to the survey using this method, lines must be run at right angles to the main traverse. This was accomplished by surveying down to the heads of the fjords, from which positions rays were taken as far down the coast and as far inland as possible. In most parts of the west coast of Graham Land the fjords run almost to the edge of the plateau, so that we were able to get direct measurements inland as well as along the coast.

South of the second base the country was much more open, consisting of a series of broad glaciers with intervening masses of rock running inland until they were buried by the plateau. These rock masses would sometimes have a frontage of 6 to 10 miles, the minor details of which were fixed with compass bearings taken at about two hourly intervals (representing a distance of 4 to 8 miles).

One of the difficulties in mapping this type of country lies in distinguishing the various features from different angles. There is an extraordinary similarity between the various outcrops and ranges, and to attempt to try and give descriptive names to all the detail was quite impossible. Certain obvious names came to one's mind at once, but these far from sufficed for reference to all the points we needed, for from a good survey station there would often be forty to fifty points to which we wished to take rays. The only solution

The Argentine Islands, with miniature ice-caps rising to more than 100 feet

Meteorological station at the Argentine Islands



Cliffs of stratified sedimentary rocks on west shore of King George VI Sound

Moss slope on one of the Berthelot Islands

Fringing glacier on the south side of Cape Calmette

therefore was to sit down and make a panoramic sketch, giving each peak or point a number and making notes against certain points which would help in the recognition of them on some subsequent occasion. This was a long, cold business, and since in the cold it was difficult to make a heavy pencil line, all the sketches had to be gone over again in the tent that night.

Before starting on a survey journey, blank charts with a field graticule were drawn on a scale of 1/500,000 for the area concerned, and on these we plotted each day's journey and the detail we had been able to fix during the day. On returning to the base, whilst the picture of the country was still fresh in our minds, a fair copy was made and a map of the whole journey produced on one sheet. The areas surveyed in this fashion were four in number:

1. In August and September 1935 we surveyed the coast and coastal islands from the Argentine Islands to Cape Evensen, 80 miles farther south. This survey was arranged when we discovered that we should be unable to sledge farther south that spring owing to the rotten state of the ice. Ryder and Bingham worked north from Cape Evensen, whilst Rymill, Fleming and I worked south from Beascochea Bay, until we met. Plane-tables were used for plotting in the detail and 80 miles of coast were plotted on a scale of 1/250,000. This map formed the basis for the hydrographic survey of the area made later in the season. The results of this survey were published in the map in the *Journal* for April, under the title of "Graham Land coast, September 1935–February 1936."

2. In July 1936, two parties were working in the area north of the second base, and east of Adelaide Island. Rymill and Bertram concentrated on the Laubeuf Fjord region and the narrow channel separating Adelaide Island from the mainland, whilst Fleming, Riley and I worked east of this in the complicated fjord region around Bourgeois Fjord. The greater part of this survey was published in the *Journal* for May in the map entitled "Southern base, Marguerite Bay."

3. In the period from 5 September to 19 November 1936 the sledging party, consisting of Fleming, Bertram, and myself, mapped the area from the southern base down King George VI Sound as far as lat. 72° 30′.

4. Rymill and Bingham, on their sledge journey from the north end of King George VI Sound due east across Graham Land, surveyed some 100 miles of the east coast. This took place in the period 26 October 1936 to 5 January 1937.

It is hoped that the map of the areas covered in 3 and 4 will appear in a later number of the *Journal*.

In addition to these, more detailed surveys were made around the two bases. At the Argentine Islands a detailed map on a scale of 1/1800 was drawn and contours inserted at 10-foot intervals. The same map was used for the detailed chart which Ryder subsequently made of the surrounding waters. These islands were exceptionally interesting from a glaciological point of view and many detailed measurements were made, as well as a map of the distribution of rock and ice at the end of the summer in 1936. This map, on a scale of 1/15,000, accompanies this paper (see folding-map).

At the southern base a similar detailed map was made on a scale of 1/3600, and the harbour and surroundings charted.

Apart from the purely topographical work, hydrographical work occupied a good deal of our time. In this section the most interesting part done was the 80 miles of coast to the south of the Argentine Islands. The Biscoe Islands, which formed the western border of this area, had been seen many times from the westward, since their discovery by Biscoe in 1832, and their western border had been charted. Between their outside edge and the mainland coast lay the Grandidier Channel, so called by Charcot. This area is strewn with small islands and there is no official account of any ship having used it, although whale catchers may have passed through it from time to time. The islands hold in the winter's bay-ice and it is not until quite late in the summer that the channel is clear enough for a ship to sail through. The larger islands were fixed during the spring sledging journey, and two flights over the islands were made later in order to enable Ryder to sketch their approximate distribution and to select a route for the ship. In February 1936, when the *Penola* was transporting the expedition from its northern to its southern base, she sailed down this channel taking soundings all the way and fixing as much detail as possible. Whilst anchored in "Mutton Cove," a harbour that had been selected from the air, Ryder made a rough harbour survey, as was customary in any harbour or shelter of which the *Penola* made use. These rough charts were usually made from the mast-head. A small boat was sent out, sounding along lines radiating from the ship to the shore, and the position of the boat at each sounding was fixed by depression angles taken with a sextant from the crow's nest, which was about 70 feet above sea-level.

More detailed harbour and approach work was done at the two bases. At the Argentine Islands much of the sounding was done in the winter, which made the determination of fixes very much simpler. A Lucas sounding machine was pulled round on a small sledge made for the purpose, and soundings were taken through holes in the ice at frequent intervals. A detailed survey of the islands having already been made, the position of the soundings was easily determined by resection from outstanding land marks.

At the southern base soundings were made with a Lucas sounding machine from the motor boat. The rocks here are almost precipitous and a sudden rise from 70 to 5 fathoms in a very short distance was quite common. This meant that one could quite easily miss a dangerous reef between lines of soundings, so that whenever a flight was made in these regions in the summer, a keen look-out was kept for submerged rocks which showed up very clearly from the air, and the following day we would go out and fix any of them which had not already been located.

The *Penola* herself was equipped with an echo sounder, sounding up to 120 fathoms, and frequent soundings were made whenever she was in uncharted waters, close to land.

We were generously equipped with instruments both by the Royal Geographical Society and the Admiralty. We took three 3¼-inch theodolites by Watts, and one 3¼-inch Wild model. The latter was used for horizontal work only owing to the fact that when the diagonal eye-piece was fitted I found it a severe strain on the eyes. The Watts instruments therefore were used for all the astronomical work, both at the base and when sledging. In the latter

case the heavy telescopic legs were exchanged for the special short "dumpy legs."

For time signals we were dependent entirely upon short-wave stations. The sets, including the batteries, were made to fit into a "sledge ration" box, 19 inches by 13 inches by 9 inches, and inert batteries were used, as it was thought that dry cells would probably deteriorate during two years. Both H.T. and L.T. batteries were contained in a wooden box lagged internally with cotton wool, but this was not effective at temperatures below zero F. when the batteries had to be warmed by a primus stove. The aerial equipment consisted of 60 feet of braided copper wire jointed to 15 feet of rubber-covered down lead, and in practice the aerial was slung between skis or ice spears. Another length of wire was supplied for use as a counterpoise, but this was never necessary. Under suitable conditions the receivers had a world-wide range to high-power transmitting stations. The following time signals were receivable in Graham Land:

Buenos Aires. Darsena Norte	34·52 metres
Arlington	33·11
Rio de Janeiro	34·8
Saigon	31·0

Saigon was usually a weak signal badly jammed by broadcasting, but the other stations were remarkably free from jamming.

We were working on standard time four hours slow of Greenwich and found the Arlington signals at 17, 20, and 23 hours L.M.T. most convenient. This signal unfortunately has no preliminaries, but the deficiency is made up for by its convenient form of transmission. The number of dots omitted at the end of each minute indicates which of the five minutes is being transmitted, so that if one picks up the station in the middle of the signal—as is usually the case when there are no preliminaries—one has only to wait until the end of that particular minute to get the time. This is a great help, especially when reception is not too good, and one is likely to miss the end of the signal. When sledging, too, and when it was only possible to spend one day at each place, we were forced to get a time signal on that particular day, or else spend another day there and repeat the observations.

The other instruments we used were all of a standard type and proved perfectly satisfactory. For navigating when sledging, an Air Ministry P 4 type of compass made by Henry Hughes & Son was used. This was fixed to a bracket that could be dropped into slots on the handle-bars of any sledge. As it was spirit-filled it never showed any tendency to become sticky in cold weather and was extremely satisfactory in every way. These compasses are clearly marked and the white needle between the two yellow lines could be seen very comfortably from the position one is in when ski-ing alongside the sledge.

The expedition's aeroplane, a D.H. Fox Moth, was used considerably for survey purposes. Whenever flights were made for other than survey purposes, as for example in flying from the Argentine Islands to the southern base, I accompanied Hampton in order to get a better idea of the country which would ultimately have to be surveyed from the ground. On such flights

sketches were made and a detailed time and distance log was kept, which helped considerably in the ground survey.

Only two flights were made over country which was not subsequently surveyed from the ground. These were the flights made to Marin Darbel Bay and over Alexander I Land in February 1937. On both occasions, before reaching the new country, we had flown some 100 miles over country that had been surveyed, and as we thereby had a check on our ground speed, we were able to plot fairly accurately our course over the new country. Unfortunately these and other areas lay so far away from the base that, from considerations of weight, we had to use the aerial camera, an Eagle III, as a hand camera through the window, rather than on its special mounting, and on all the flights photos were taken in this fashion.

METEOROLOGY: A. STEPHENSON

As no work yet has been done on the meteorological observations which we brought back, no more can be done at the moment than enumerate the observations made and give a general idea of the conditions at the two stations and of the general conclusions to which we came.

In mentioning two stations I refer to the first base at the Argentine Islands in lat. 65° 15′ S., 64° 16′ W., and the southern base at Barry Island in Marguerite Bay in lat. 68° 08′ S., 67° 05′ W. Unfortunately these observations followed on each other, and were not simultaneous. The only previous observations taken on the west coast of Graham Land were those of Doctor Charcot's expeditions in 1903–5 and 1908–10, and of Bagshawe in 1920–21.

We carried out an almost identical programme at both stations. The observations for the greater part of the time were taken by Quintin Riley and myself, and when neither of us was available Lieutenant Meiklejohn carried on. The Meteorological Office equipped us very generously with instruments, and I should like to record our gratitude to the Director, Sir George Simpson, F.R.S., and to Dr. Stagg and Mr. Dynes, for the interest which they took, and for their valuable advice concerning our projected programme of work. At each station we had the following instruments in commission:

In the base hut itself were installed a barometer, weekly barograph, and a distant recording thermograph. Outside we had a Stevenson screen containing maximum, minimum, and dry-bulb thermometers; a weekly thermograph and hair hygrograph, and hygroscope. A sunshine recorder and Besson nephoscope were set up close to the screen, and in a small hut we housed the Baxendell wind direction recorder and the Lownes anemometer, the cups of which were attached to the roof of the small hut.

We were working on a L.M.T. four hours slow of Greenwich, and observations were made at 09, 12, 15, 18, and 21 hours L.M.T. These observations were recorded in the Large Pocket Register of the Meteorological Office.

At the Argentine Islands the station was set up on the summit of Winter Island, one of those peculiar ice-covered islands which rises to 110 feet, with occasional strips of rock jutting out from underneath the ice just above sea-level. It was on one of these promontories of rock that the base was built. The house itself was in a low and sheltered spot and we were obliged therefore

to set up our screen on the nearest exposed place, which was on the summit of the island. This entailed a three-minute walk and a steep climb each time we did the observations, but it was well worth while since from the top we had a splendid view all round, as well as a better idea of the true air conditions. There was an uninterrupted view, with excellent land marks for visibility points excepting to the west out to sea. The mainland coast was 5 miles away, containing numerous peaks of known heights rising up to 6000 feet, which facilitated our estimate of cloud height, whilst to the north on clear days the 10,000-foot peak of Mont Français was visible.

As has been seen from the Glaciological Report, these islands form one of the many interesting features on this coast. Their present covering of ice seems indicative of a different regime of weather at some other time or other, and their formation was a matter of continual discussion. In connection with this, numerous "snow poles" were distributed over the islands and regular readings made. Dyes were also spread out in known places, in an attempt to get an idea of the annual snowfall.

At the second base a similar programme was carried out, but here the conditions were not so ideal. We were close in to the shore and were subject to severe gales from off-shore, their direction being determined by the topography rather than by the distribution of pressure. To the south-west of us there was a large island deflecting most of the winds from that quadrant, so that our record of wind direction is not so reliable as in the previous year. Whenever possible however the direction of movement of the low cloud was recorded.

The instruments were erected on a hill 50 feet above sea-level immediately behind the base. Continuous automatic records were kept as in the first year, excepting for the wind force. Unfortunately the anemometer cups were blown off in a gale and, after refitting, the instrument recorded nothing under Force 4. The instrument was in working order for a sufficient length of time however to give us a good idea of the strength of some of the easterly gales which reached speeds of 100 and 110 m.p.h. These gales were often of considerable duration and more than once lasted longer than five days, the longest being of eight days' duration. At times these winds seemed to bear some relation to the variation in pressure, but quite often, once they had started, they continued to blow in the same direction and with the same force, regardless of what the barometer was doing. The temperature was considerably higher during a gale from the east than when light, easterly winds were blowing, but the rise was no more than we usually got with a northerly or north-westerly wind, and as the gales were probably north-easterly in origin, it seems that the rise in temperature was not necessarily due to any föhn effect. In fact, during most of the gales in May a fall in temperature was experienced.

The most remarkable changes in temperature were experienced in late winter and spring when the wind was in the north-west quadrant. On these occasions a very slight change in direction, from N.N.W. to W.N.W., or even less, brought a fall of temperature from the plus 30's to the minus 20's F. This presumably was connected with the distribution of ice out to sea, and was comparable with the variations in weather which we got in the Argentine Islands, with the various movements of the ice. The amount and distribution

Meteorological Table Compiled from Observations made from March 1935 - January 1936

B.G.L.E. Base, Argentine Is. *Lat. 65° 15' S Long 64° 16' W* — *110 feet above M.S.L.* — *Daily observations at 09.00 12.00 15.00 18.00 and 21.00 hours Standard Time 4 hours slow on G.M.T.*

	* Mean pressure at M.S.L.	Air Temperature °F.					* Mean cloud	Mean daily sunshine	* Wind											Days of	
		Mean daily			Extremes				Mean velocity	Percentage and Mean Beaufort Force											
1935	Millibars	Average	Max	Min	Max	Min	Tenths	Hours	M.P.H.	N	NE	E	SE	S	SW	W	NW	calm	Fog	Gale
March ‡	973·9	31·8	35·5	28·1	42·5	24·8	7·3	no record	5·3	11% 3	14 4	9 2	18 2	14 2	9 2	2 2	2 1	21% 0	0	2
April	993·2	26·4	29·5	23·2	43·0	16·4	7·7	1·9	7·1	21 4	14 3	5 4	14 3	21 2	9 3	1 2	2 3	13 0	4	2
May	991·5	24·7	28·3	21·2	47·2	13·8	7·8	0·8	8·4	17 5	17 3	7 1	12 2	16 2	9 2	5 3	5 1	12 0	3	4
June	995·1	23·7	26·9	20·6	40·0	13·5	6·6	0·6	6·2	16 4	16 5	8 2	8 2	21 4	6 2	1 1	4 2	20 0	2	3
July	997·9	12·5	17·8	7·2	29·5	-9·8	7·0	1·2	6·7	4 3	11 2	7 3	25 2	28 3	13 3	1 3	1 2	10 0	1	2
August	991·1	-1·0	4·9	-6·9	38·0	-21·2	6·1	1·8	6·8	3 6	7 5	3 1	15 1	38 2	22 2	5 3	2 2	5 0	5	2
September	996·8	11·8	18·3	5·4	34·7	-28·1	7·3	2·7	5·3	8 4	3 1	4 2	26 2	32 2	11 2	2 2	2 2	12 0	5	2
October	994·3	26·0	30·3	21·6	35·9	-2·0	9·2	1·4	13·1	43 6	6 2	1 3	10 2	12 2	5 4	10 4	8 4	5 0	7	8
November	986·3	27·5	31·7	23·2	39·5	5·5	9·4	2·5	7·3	26 3	3 3	2 2	11 2	32 3	7 3	2 2	7 3	10 0	0	1
December	992·2	32·9	36·1	29·7	43·5	22·0	8·7	3·5	6·4	11 3	7 2	7 2	18 2	23 3	9 2	4 1	10 3	11 0	2	0
1936 January	993·9	35·3	39·5	31·1	45·1	28·0	8·4	4·1	9·5	13 3	10 4	6 2	14 1	22 2	10 2	1 1	6 2	18 0	2	0

* *Mean of five observations daily* ‡ *28 days from March 4th only*

Meteorological Table Compiled from Observations made from March 1936 - February 1937

B.G.L.E. Base, Barry Is. Lat. 68°08'S. Long. 67°06'W. — 50 feet above M.S.L. — Daily observations at 09.00 12.00 15.00 18.00 and 21.00 hours Standard Time 4 hours slow on G.M.T.

1936	* Mean pressure at M.S.L. Millibars	Air Temperature °F. Mean daily Average	Mean daily Max.	Mean daily Min.	Extremes Max.	Extremes Min.	* Mean cloud Tenths	Mean daily sunshine Hours	Mean velocity M.P.H.	* Wind Percentage and Mean Beaufort Force N	NE	E	SE	S	SW	W	NW	Calm	Days of Fog	Days of Gale
March ‡	979.8	29.7	33.9	25.4	47.2	14.9	8.0	2.2	7.8	11% 2	18 3	22 5	9 1	4 1	0 0	6 3	14 3	16% 0	2	3
April	989.2	25.1	30.1	20.2	42.8	7.0	8.0	1.8	7.1	14 2	21 2	25 4	5 2	5 2	2 2	5 2	9 3	14 0	1	6
May	993.2	7.7	14.1	1.4	27.5	-18.0	7.4	*	13.4	10 2	16 3	33 7	10 3	3 1	1 1	2 3	9 3	16 0	1	10
June	993.3	0.1	9.7	-10.5	37.1	-37.0	6.2	*	6.8	17 4	8 3	7 4	20 2	8 2	4 3	4 3	13 3	19 0	2	4
July	991.3	6.3	18.1	- 5.6	43.9	-36.5	7.5	*	7.1	16 4	9 4	11 3	27 2	7 2	2 1	7 4	24 4	28 0	0	3
August	994.7	6.0	17.2	- 5.1	39.5	-30.0	7.2	* 1.5	8.0	9 4	7 3	14 5	15 2	8 2	1 3	7 4	15 5	24 0	3	9
September	979.7	20.1	5.2	12.7	43.0	-22.0	8.3	1.3	6.0	8 3	9 3	16 5	6 1	6 3	5 2	9 2	14 3	27 0	1	6
October	989.3	28.0	9.9	18.9	40.5	-15.2	7.5	3.8	12.0	14 4	3 5	16 6	14 1	8 2	4 2	5 4	18 5	18 0	1	10
November	982.7	32.8	26.0	26.3	42.0	-8.4	8.5	3.2	8.1	18 3	9 4	13 6	11 2	11 2	3 1	5 1	15 3	15 0	0	5
December	981.7	34.9	40.4	29.4	44.5	18.0	7.6	6.9	16.2	6 2	3 3	50 7	13 2	8 2	1 3	1 2	9 1	9 0	2	14
1937 January	990.2	34.5	39.0	30.1	48.9	20.0	7.8	7.0	9.5	10 2	4 4	26 6	19 1	13 2	3 3	2 1	13 3	10 0	2	4
February †	991.6	31.3	35.8	26.9	44.1	20.0	6.5	5.4	11.0	7 2	4 2	37 6	21 2	4 2	1 2	1 2	11 3	14 0	1	6

* Mean of five observations daily

‡ From March 12th only

† To February 23rd only

* Sun failed to record or was below horizon from May 4th to August 13th

of ice plays a great part in determining the weather experienced on this part of the coast, more particularly with regard to temperature, cloud, and fog. This makes a comparison of the work of one expedition with that of another, or even of one year's observations with the next, difficult, since the variations are controlled by the presence or absence of ice, which is not dependent upon local conditions.

This difficulty was emphasized when studying ablation on the ice-covered islands in the Argentine group. There was a big difference in the amount of exposed rock at the end of the summer in 1936 compared with what we found in 1935, and the question arose as to which was the normal year and which the exceptional one. Reference to Charcot's observations taken 6 miles farther north merely increased the difficulty. There are numerous problems of this nature both glaciological and meteorological, which we hope will be clarified, if not solved, by a study of the observations brought back.

When the *Penola* returned from Deception Island with the mail (brought out by Mr. Lincoln Ellsworth) at the end of the summer in 1936, we received a Michelsen actinometer which had been sent out, so that during the second year we were able to make regular observations of the actinic value of the sun's rays. Unfortunately, glaciological conditions at the southern base were quite different, and the islands were no longer covered by small ice-caps but consisted mainly of exposed rock.

On the whole however the conditions at the two bases were fairly comparable. During the first year we plotted charts each month to show the relationship of cloud, pressure, and temperature, with the different wind directions. These charts showed that the prevalent winds were from between south-east and south-west, whilst the dominant winds were from the north-east quadrant. Usually the temperature was above the monthly mean when the wind was from the north-east, and below it when from the south. In winter this was accentuated, and in summer the same relationship held, but to a much smaller extent. At both stations high temperatures were recorded in the winter with north-easterly winds, the maximum for the first year of $+47°$ F. occurring with such a wind. The absolute maximum for the second year, which was $+49°$ F., occurred in the summer. The minimum temperature at the Argentine Islands was $-28°$ F. occurring in September, whilst at Barry Island the minimum of $-37°$ was recorded in June. The monthly means in the Argentine Islands varied from $+35°3$ F. in January to $-1°0$ in August, the mean for the year being $24°7$, whilst at Barry Island, some 200 miles farther south, they varied from $+34°9$ in December (January being $34°5$) to zero in June. The mean for the year was $21°4$. These values were worked out in Graham Land and are based on the five daily observations and the daily maximum and minimum readings (see accompanying tables, pp. 520–1).

Regular observations were maintained throughout eleven months at the Argentine Islands and twelve at Barry Island. In addition to these, regular observations were taken on sledging journeys and at sea, many of which provide interesting observations contemporaneous with those taken at the base. As an example, a gale which we experienced at Barry Island in February 1937, and which we thought was confined to the coastal regions, was also

reported by the *Penola* 100 miles out to sea, where it was blowing in approximately the same direction and with much the same force.

No upper-air work was attempted, but air temperatures were taken during every flight which the expedition aeroplane made, and notes made on any special phenomena. In winter an inversion of temperature was usual, amounting to a rise of 20° F. in 2000 feet. Frequently there was a difference of 5° F. between the distant recording thermograph at the base and the screen temperature 50 feet above sea-level.

No magnetic observations were made, and the Aurora Australis was only seen on two occasions. These were in April and July 1936, when faint "rays in masses" were seen in the southern sky, chiefly yellow, but some with a faint pinkish tinge.

TIDAL OBSERVATIONS: B. B. ROBERTS

During the first winter at the Argentine Islands an automatic tide-gauge was constructed and worked from the ship while she was fast in the ice of Stella Creek. With this instrument thirty-two consecutive weeks' record was obtained (16 May to 27 December 1935). Based on the experience gained with this, a second and more satisfactory gauge was built for use in Marguerite Bay, and another continuous run of twenty-two weeks was recorded at the southern base (2 July to 5 December 1936). Owing to the difficulties caused by drifting ice it was only found possible to work these gauges when the sea was well frozen over. The charts are now being examined at the Liverpool Observatory and Tidal Institute.

PLANTS AND SEALS: G. C. L. BERTRAM

When the expedition left England it seemed most probable that my chief work would be of an oceanographical nature with shorter periods of intensive work upon the marine littoral and shallow-water fauna. However, as is often the case on polar expeditions, circumstances were such that a very different class of work was carried out, and in the end the amount of oceanographical work done was negligible. At an early stage it became clear that a detailed study of the biology of the antarctic seals was the most profitable line to pursue, and throughout the remainder of the expedition this study became my main concern. Before proceeding to a short account of this piece of work certain subsidiary studies may be briefly mentioned.

The Argentine Islands, where the expedition spent its first year, were of exceptional interest. It is not an exaggeration to state that this region is botanically the richest in the whole of Antarctica (*i.e.* excluding the sub-antarctic islands).

The islands possess a peculiar luxuriance of vegetation. The most remarkable feature is the sporadic occurrence of a closed moss association, the largest area of which covered almost an acre, and this on a small island whose southern part was heavily glacierized. In its highest development the dominant moss had formed a "peat," even 3 feet in thickness, albeit permanently frozen except for the top few inches in summer. This moss sometimes grows so

vigorously at the cliff edges that large tussocks become detached and roll down into the creek below. These patches of moss were normally, but not invariably, areas which had a northerly aspect and remained continuously well blanketed by snow during the winter. Observations on the extent of this insulation of the moss from the lowest temperatures of the environment were made with a two-bulb thermograph.

These flourishing moss areas occur only on a certain type of well-sheltered inshore island, for the lower slopes of the mainland are too heavily encumbered with ice, while islands that are low or more exposed are liable to a frequent drenching with salt spray. South of the Argentine Islands a single similar area of this closed moss association was found: half an acre on Léonie Island in the north of Marguerite Bay. This position too was the only locality, apart from one of the Argentine Islands, where there were a few plants of *Colobanthus crassifolius*, one of the two species of flowering plants known from Antarctica. The other of these two species, *Deschampsia antarctica*, a grass, was found rather more frequently, in scattered small tufts at a number of places between Deception Island and Marguerite Bay. These two flowering plants have so far been recorded from nowhere else on the continent, except the Graham Land peninsula. Apart from the other signs of peculiar vigour of moss growth in these special places, certain of the species, though not the dominant one, frequently produced fructifications, a phenomenon that is normally rare in the Antarctic.

The lichens too, in especially favourable situations, reached a considerable degree of luxuriance. Particular attention was paid to the variations of the lichens in relation to the immediate local environment, snow cover, aspect, protection from drift, and so on. As evidence of the extreme slowness of lichen growth in certain instances, may be adduced the fact that the stones composing a cairn erected by Charcot in 1909 still clearly possessed the original orientation of the lichens upon their surfaces.

Passing from the plants to the animals, the Argentine Islands harboured a variety of forms as great as anywhere in Antarctica. Apart from the several species of Mites and Collembola, considerable numbers were seen of the wingless gnat, *Belgica antarctica*, which is about 5 mm. in length, and is the largest permanent terrestrial inhabitant of the antarctic continent. On sunny days in the summer these small gnats crawl about on the surface of the damp mosses among which their larvae develop.

The few shallow freshwater ponds of Antarctica, continually frozen except for a brief period in summer, are virtually devoid of those numerous species of small Crustacea that are such a feature of the ponds of high arctic regions. But in one or two instances in the past individuals of a species nearly akin to the "fairy shrimp" of northern lands have been found in ponds on the off-lying islands of northern Graham Land. Similar sporadic occurrences of this species were seen by the present expedition, one of them for the first time being south of the antarctic circle, on an island in Marguerite Bay. As well, in a pond on this same island, were found individuals of what is believed to be the first species of Copepod (water flea) ever found in Antarctica.

The marine fauna in the shallow waters near the west coast of Graham Land is evidently rich. Circumstances were such however that, apart from a

number of dredgings made in less than 10 fathoms in the open season, little attention could be paid to it. Small water samples were taken weekly during the winter at the Argentine Islands in an investigation of the state of the phytoplankton throughout that period.

As already stated, a detailed study of the antarctic seals was the major work that was undertaken. In order to satisfy the requirements of the members of the expedition and of their numerous dogs, it was necessary to kill a very large number of seals for food. For this reason about 550 seals were killed, and I took every opportunity to carry out the work myself, thereby making sure of the measurements, specimens, and observations, that were needed; though, of course, this was far from possible in every case. There are four species of truly antarctic seals, but of these one, the Ross seal, is excessively rare, and was not found. Of the Ross seal in fact probably fewer than fifty individuals have ever been seen. Another species, the leopard seal, which may reach an overall length of more than 13 feet, is a predaceous wanderer feeding for the most part on penguins, and being solitary in its habit, little more than a score were killed in the course of the expedition. The leopard seal too is peculiar in that the male is smaller than the female, a strange contrast with those polygynous species such as the elephant seal, where the male is vastly more massive than his mate.

The two most abundant species of antarctic seal are the crabeater and the Weddell, of which about 150 of the former, and more than 350 of the latter were taken.

The crabeater is essentially a gregarious seal of the pack-ice, being lithe and active, and feeding on Euphausids, the main constituent of the 'Krill' upon which subsist the greater whales. On the west coast of Graham Land there is a marked influx of these seals at the beginning of the new year, when most of the drifting ice of the past winter has dispersed. At this time the moulting seals lie out together in groups on the floes. Almost all the individuals of this species bear on their flanks and bellies the parallel scars of severe lacerations from the teeth of killer whales.

As the winter approaches the crabeater seals leave the coast and presumably spend the winter near the edge of the pack, and it must be there that pupping takes place. Except for one or two individuals seen by members of the *Belgica* and *Endurance* Expeditions, the pups of the crabeater seal are quite unknown. In the course of the present expedition it was hoped to fly out over the pack to search for, and make observations upon, the breeding crabeaters, whose time of pupping had been determined from an examination of foetal material. Unfortunately, for technical and mechanical reasons in both years, a flight proved impossible. A very small number of crabeater seals were found to spend the winter inshore beneath the ice, but these all proved to be males, except for two females, which were abnormal in being not pregnant at this season.

The fourth species of antarctic seal, the Weddell, is in very marked contrast with the crabeater. The Weddell is slightly the larger, sometimes reaching a total length of 10 feet, and is essentially a sluggish inshore animal, feeding upon fish and squids, and preferring to haul out on a beach rather than on the ice. During the winter the Weddell seals live beneath the bay-ice, keeping

open a number of holes for breathing, but rarely emerging until the pupping time in early spring, when groups of females tend to congregate in sheltered creeks and bays.

In this investigation of the antarctic seals, so far as possible, the body length of every individual was measured, and an examination made of the viscera. The gut was opened and the parasites examined in its various parts. Here again the Weddell and the crabeater seals were in marked contrast, the former invariably possessing a heavy infection with a variety of forms, the latter rarely harbouring a single species. Many specimens of the different kinds of gut parasites were preserved, and at the same time a large collection of foetal material and ovaries was made for later examination. From these three species a long series of skulls, some 140 in all, was prepared and brought home for detailed comparison. When the examination and analysis of all the data and material is complete, it should be possible to present an accurate picture of the breeding biology and status of these antarctic seals.

BIRDS: B. B. ROBERTS

While planning the ornithological work of the Expedition in 1934, a search through the literature of the subject, and of the skins in the British Museum, soon made it clear that there would be no lack of problems to study if our base was not established too far south on the Graham Land coast. Many more skins are required before there can be any sound classification of the birds of the southern ocean. Very little had been published about the habits of any antarctic birds except penguins, and of these there were a large number of conflicting accounts. Anatole France must have read some antarctic bird reports before he wrote in the introduction to 'L'Ile des Pingouins': "When a fact is known through the evidence of a single person, it is admitted without much hesitation. Our perplexities begin when events are related by two or by several witnesses, for their evidence is always contradictory and always irreconcilable." My preparations took the form of a long list of questions to which it was hoped there might be opportunities for finding an answer.

If we take the antarctic convergence as a northern boundary, there are in the Antarctic about fifty-six species of birds which a voyager might expect to see. Of these, thirty-two are petrels and eight are penguins. They are all sea birds except the sheathbill, the South Georgia pipit, which is the most southerly in its range of all land birds, and the ducks which are found on South Georgia, Kerguelen, and the Crozet Islands.

Little is known about the habits and lives of oceanic birds, except during the short season when they come ashore to breed. For two-thirds of the year, when they are at sea, regular observations are impossible; and in order to obtain a picture of their wanderings over so vast an area, we have to depend on what can be learned incidentally during occasional voyages undertaken for some entirely different purpose.

Many of these oceanic birds have clearly defined limits to their ranges at different times of the year. Some are circumpolar in their distribution, and occur in zones which move north and south with the changes in season. Only three, in fact, are exclusively birds of the far south, the Emperor and Adélie

penguin and McCormick's skua. The Graham Land peninsula extends northwards through several of these zones, and thus forms a region which is well suited for a study of the possible factors which are responsible for the limitation of the distribution of the various species. The problems of bird distribution are also bound up with those of numbers. It is probable that nowhere else in the world can such huge flocks of birds be seen as in the Falkland Islands Dependencies.

Altogether the *Penola* sailed about 27,000 miles during the two and a half years we were away from England. And although this was very tedious in some ways, especially when we were becalmed for long periods, it did give excellent opportunities for bird observations. By using the old sailors' method of a baited triangle, we succeeded in catching quite a number of birds, which I was able to examine for parasites and to see what they had been eating. Regular standardized counts of oceanic birds were made during all voyages of the *Penola*, during a trip which I made from the Falklands to Magallanes and back in June, 1936, and during a short cruise with *Discovery II* from South Georgia to the Falkland Islands *via* the South Orkneys and Clarence Island in November 1936. When these observations are plotted on charts they should give information as to the distribution and approximate density of each species.

Apart from the collection of specimens, most of my time ashore was spent on detailed studies of bird behaviour. When studying bird behaviour under natural conditions, the usual method is to watch individuals for long periods and record any facts which seem important. Another way is to take a particular form or variety of behaviour, such as courtship, and compare its manifestations in a large number of species. There is a third way too, and that is to select one species for a concentrated study of the whole or part of its life history. The three methods supplement each other, and all were used at different times. In Graham Land I chose one bird for a special study. We were lucky at the Argentine Islands in having quite close to our base a small colony of Wilson's petrels: little birds which migrate every year to the North Atlantic, but of whose breeding habits practically nothing was known. In this colony all the burrows were excavated so that twenty-three pairs could be kept under daily observation throughout the whole breeding season without being disturbed. The comings and goings of one pair were automatically recorded by means of a thermograph, and every bird in the colony was marked with a small numbered aluminium ring. In this way it was possible, for example, to determine what share each sex took in incubation and the care of the young. An interesting discovery was that, in spite of their long migration of over 20,000 miles, these birds returned each spring to the same burrow and mate. The growth rates of the chicks proved interesting, as also did their extraordinary powers of resistance to the rigorous environment. Towards the end of the season they were frequently blocked in their burrows by snow so that their parents could not get in with food. On these occasions the chicks stopped growing and lived on their own fat reserves. One of them was buried in this way for twenty days and yet survived.

New information was also collected in Graham Land on the breeding and ecological relationships of the blue-eyed shag, Dominican gull, brown skua,

antarctic tern, Cape pigeon, and silver-grey petrel; and in the Falkland Islands, of the sooty shearwater, Cape hen, and grey-backed storm petrel. It was however rather difficult to make regular observations on some of these in Graham Land because the sledge dogs used to swim over to the various islands near the base and eat my marked birds. On the other hand, the remarkable tameness of nearly all antarctic birds makes up for many other disadvantages. With most of them it is not necessary to crouch for long periods in the discomfort of a small "hide" in order to watch their behaviour at close quarters. Indeed, the climate would generally make such methods anything but pleasant for the observer.

Penguins are the most interesting of all southern birds. In Graham Land, South Georgia, and the Falkland Islands there were good opportunities to watch seven species: king, Gentoo, Adélie, ringed, macaroni, rockhopper, and Magellan penguins. Much of my time was therefore spent in their rookeries. By marking individual birds with spots of different-coloured paints, it was possible to follow their movements from day to day, and to make a start in solving some of the problems of their social habits. But because of the uncertainties involved in attempting to reconstruct a picture of social life in a bird colony, it is all too easy for an observer to convince himself that the behaviour supports whatever views he may happen to have held when the observations were started. In the case of penguins, and in fact many other birds or animals, it is remarkable how their behaviour often conforms to the national characteristics of the different authors who have described them. An attempt was made therefore to treat behaviour as the result or expression of physiological processes initiated by the environment, and to use this as the basis for investigation instead of assuming that each action has a human and intelligent background. Penguins are not so intelligent as popular opinion would like us to believe. Experiments were designed to obtain information about such things as their powers of discrimination and associative memory, of their ability to profit by experience, and of their capacity for adaptation to new conditions.

In all birds there is a regular "pattern" of behaviour during the breeding season. In simple form this may be described as the standard behaviour during courtship, nest-building, the laying of the eggs, incubation, and care of the young. During each of these stages the actions of the birds follow a fixed pattern which is correlated with a definite sequence of physiological stimuli apparently controlled largely by spring weather conditions. These different phases of behaviour are especially well marked in penguins, and observations were made with a view to discovering the relationship between these phases and the condition of the gonads.

The positions of the penguin rookeries were plotted on maps in the Falkland Islands and South Georgia and, with less completeness, in Graham Land and the South Shetlands. Estimates of the numbers of the two chief species in the Falklands and a census of king penguins in South Georgia were also made. Material has in fact been collected to map out their distribution, and to analyse some of the possible factors which may influence their distribution and numbers. In addition, it has been possible to fill up many gaps in what was known of their life histories and breeding biology.

DISCUSSION

Before the papers the PRESIDENT (Professor HENRY BALFOUR) said: This afternoon we are to be given a brief survey of the scientific results of the British Graham Land Expedition. That expedition lasted for two and a half years, and four members of the expedition will summarize the work done in the various departments.

The papers printed above were then read, and a discussion followed.

The PRESIDENT: I invite any one present to make comments or ask questions on the communications which have been made to us.

Mr. T. J. RICHMOND: As a representative of the Hydrographic Department, I should like to be assured, if possible, of the reliability of the four or five astronomical positions forming the basis of the southern portion of the survey. We are at present bringing the Admiralty South Polar chart up to date. It would be a great help if we could be tolerably sure that the whole triangulation, which was obviously done with much care, is fairly accurately fixed in latitude and longitude. I may remind you that in charting the coast-line of the Antarctic explorers have given very different versions. An example may be given from the work of the B.A.N.Z. 1931 Expedition. This expedition mapped the coast-line from MacRobertson Land eastward, and another national expedition confirmed the trend of the coast in the area of MacRobertson Land. But towards the east quite large amendments in the B.A.N.Z. version of the coast-line have been made by later expeditions, and there is probably a somewhat large error in the chart. Cape Amery was one of the salient points laid down in the 1931 survey. In the account of a subsequent visit, in 1936, by the *William Scoresby* it is stated that "no evidence of Cape Amery was found"; and some distance south of this point as fixed by the B.A.N.Z. Expedition the *William Scoresby* placed the Ice Barrier. I should like to emphasize the desirability of knowing approximately the probable error in the positions, especially of the southern portion of the survey.

Mr. A. STEPHENSON: I must thank Mr. Richmond for raising the question of the reliability of our astronomical positions. The most detailed charts that we have produced are of the waters in the vicinity of our two bases, the surrounding areas of which we surveyed in detail by a plane-table survey based upon a theodolite triangulation. At these bases a series of observations both stellar and solar were made throughout the year; the accuracy of these positions is within 5 seconds for latitude, and for longitude about 45 seconds of arc, in the appropriate latitude.

On sledging journeys the accuracy of the determinations is less, but these observations are used merely to control the coast-line which will be mapped on a very small scale. The conditions in which these observations were made varied considerably; in some cases one might get an afternoon observation only, and in others one might be in an area for a whole week and get two or three complete sets of observations. On those occasions when we were able to get a complete set of observations in one place, the order of the probable error in latitude is about $\pm 0{\cdot}6'$ and in longitude $\pm 1{\cdot}7'$. It is impossible to give a general figure for the accuracy of all the observations, but as a rule it may be said that they lie within the plottable error of the maps in which they will be used.

If on any map which we publish there should be any great difference in the accuracy of different portions of the survey, a note to that effect will be made.

Sir GEORGE SIMPSON: I would like to take this opportunity of congratulating the members of the expedition on the excellence of their scientific work. We

have certainly got right away from the days when a scientific expedition consisted of one or two officers, who had probably been trained in the Navy, and half a dozen able seamen, who went into vast unknown regions and returned with little additional scientific knowledge. Nowadays the men who go on expeditions are not even observers; they are scientists. They know the problems and know what they are looking for.

I have a great deal to do with preparing expeditions not only to polar regions but elsewhere, and I will not waste my time trying to teach men to take observations about which they know nothing. It is not enough to give a man an instrument, and then send him to some outlandish place to expose that instrument and take readings. It is only possible for meteorological work to be done by men like Mr. Stephenson, one of our most experienced polar meteorologists and surveyors, so that we can depend on the results brought back.

Mr. Stephenson's account of the meteorological work recalled to me my own experiences with Captain Scott. There was the same trouble of having to get some one to take observations when one was away, so as not to break the series, and also the difficulty of finding a position in which to put the anemometer so that it was possible to get at it. I can also picture them going out to their instruments in all kinds of weather, battling through snowdrifts to take their observations. Mr. Stephenson told us, and I must congratulate him on it, that he has almost an uninterrupted series of observations. That is one of the essentials. It is no good going to any of the polar regions and taking observations just when there is time. There must be a complete series so that there is a complete year's observations. There is of course the difficulty that Mr. Stephenson mentioned, that as they were down in the region for only two years they do not know which of the two years was abnormal. Of course neither was. They were both normal, but it is necessary to cover many years in order to get an average which is fixed. Hence the need for one or two permanent observatories in the Antarctic where regular observations can be made of meteorology, terrestrial magnetism, and aurora, and where of course a constant record of the migration of the animals would be kept. I am quite sure the time has come when we must press very strongly indeed for one permanent observatory of that kind in the Antarctic, and I should like to see two.

I was particularly interested in the remarks made on the recession of the ice; and the suggestion that the ice-sheet on many of the islands is part of the big glaciation during the last Ice Age. I think that is perfectly true. In fact, I believe that the whole of the antarctic ice is nothing more than the remains of the Pleistocene glacial ice-sheet and that at the present moment a complete recession is taking place. I remember Sir Sidney Burrard once remarking to me that he believed that the vast ice-sheets on the Himalayas are simply relics of the Pleistocene glaciation. It seems to me that there is a good deal of truth in that. In fact, we are, I think, just passing out of the last glacial period, and thus we find these traces. The traces which Mr. Rymill's expedition found we found also in the Ross Sea area, and one knows that such traces are to be found practically over all parts both of the Arctic and Antarctic.

Finally, I would again like to congratulate Mr. Rymill and his scientific men on the excellence of the results which they have brought back.

Mr. W. Campbell Smith: I am very pleased to hear the excellent account of the work done by the Graham Land Expedition, and Mr. Fleming's description of the geology. I look forward to the more detailed examination of over a thousand specimens of rocks which he has collected. I would like heartily to endorse the last speaker's remarks and to congratulate the members of the expedition on the scientific work they have done. I hope

that ample means will be found for publishing the results, and also that the members of the scientific staff of the expedition will be able to afford time, and that means will be found to help them, to work out the results of what I feel has been a most successful expedition. Both those factors, time and money, are most important. We are still working at, and others are still waiting for reports on, the collection brought back by Scott's last expedition. We are in the same plight with regard to Mawson's last expedition. In both cases the delay has arisen because there is a shortage of funds and, as always, a lack of opportunity for the scientific members of the expedition to do the work while the subject of it is fresh in their minds. I am sure the results brought back by the British Graham Land Expedition are well worth working out. I hope those in a position to encourage the Institutions of this country to help the expedition with funds in aid of the working out and publication of results will do their best in that direction. They will be doing useful and good work.

Mr. A. R. HINKS: If I understood Mr. Fleming aright, he said a piece of limestone similar to that found in Alexander I Land had been brought back by a previous expedition from somewhere near one of the islands in the north of Graham Land. Am I right; and if so could he say where the other piece came from?

Rev. W. L. S. FLEMING: From Hope Bay near the northern end of Graham Land. The islands in the south of Graham Land belong to the same formation as Graham Land itself. Adelaide Island, for example, is not sedimentary. Alexander I Land is the only occurrence of unmetamorphosed stratified rocks which is to be seen other than right up in the far north of Graham Land. From the outcrops which we were able to visit, and from the geomorphological evidence, it is clear that the other islands off the western coast of Graham Land consist of igneous and metamorphic rock types analogous to those of the mainland.

Mr. HINKS: It seems to me that the discovery of the strait or sound between Alexander I Land and the west coast of Graham Land is one of the most striking features of the expedition and I am wondering whether Mr. Fleming can say whether it is tectonic. That is what suggested my question with regard to the limestone. Is there any evidence that the sound is a rift valley?

Rev. W. L. S. FLEMING: There is insufficient evidence of that. The origin of the sound is tectonic, not erosional. Many of the straits which separate the larger islands farther north from the west coast of Graham Land may well be ascribed to the same tectonic origin as the big sound, despite the fact that they are not bounded (as is the big sound) on their western side by sedimentary rocks.

Mr. HINKS: It has been a matter of some discussion and question whether there is evidence that this is a passage-way right through and out to sea; whether it is properly called a sound or a strait. I gathered from Mr. Fleming that the surface of the ice in that region was about 700 feet high. Was there any indication that that was about the summit and that the ice fell away again to the south?

Rev. W. L. S. FLEMING: It is very difficult to say. From our turning point the surface of the shelf-ice in the bay opening to the south coast appeared to be level, but it would have been difficult to detect a very gradual rising gradient in that direction and of course impossible to tell if the gradient sloped away from one. We can only say that from this most southerly camp we had a completely open view of the coast-lines on both sides of the sound, and that between them was an open expanse to the south west with nothing rising above a level and unbroken snow horizon. The view was uninterrupted on a clear day with perfect visibility. We sometimes found it difficult to detect a rise or fall of the

shelf-ice surface, but we were generally able to do so when sledging. In clear weather when following a team some distance ahead it is possible to see whether the surface is rising, falling, or level.

The PRESIDENT: You will all agree with me in thinking that each one of the four sections dealt with to-day could have occupied the whole afternoon with great advantage to us all. The members of the expedition are to be highly congratulated on the work which they have got through, and we look forward to the whole of the results becoming available. But we may have to wait some time before we have fully realized how much work was done during the two and a half years' expedition.

I ask you to thank all those who have spoken and have given us these necessarily much condensed accounts of the scientific activities of the British Graham Land Expedition.

THE PERCY SLADEN EXPEDITION TO LAKE TITICACA, 1937

H. CARY GILSON

Evening Meeting of the Society, 4 April 1938

THE idea of an expedition to Lake Titicaca was put forward by representatives of the Sociedad Geográfica de Lima at the International Geographical Congress at Cambridge in 1928. At that time it was not a financial possibility, but in 1936 the suggestion was brought to the notice of the Percy Sladen Trustees by Professor Stanley Gardiner, and the expedition owes its existence to their decision to finance it, and to the enormous amount of work undertaken by Professor Gardiner in making preliminary arrangements, and securing the consent and support of the Governments of Peru and Bolivia and the invaluable help of the Peruvian Corporation, who run the Peruvian railways and the steamer services on Lake Titicaca.

The Percy Sladen Expedition consisted of six members besides myself: Mr. G. I. Crawford of the British Museum in charge of all the collections; Mr. T. G. Tutin of Downing College, Cambridge, as botanist; Messrs. H. P. Moon of University College, Southampton, and P. F. Holmes of Trinity Hall, Cambridge, as zoologists; Mr. H. E. Hinton of King's College, Cambridge, as entomologist; and Mr. D. M. Hall of Trinity College, Cambridge, as chemist. Hinton and I left in advance of the others on February 18 of last year to pay our respects to the authorities and make preliminary arrangements in Peru. The rest followed on March 11 and arrived on the lake on April 12. We left Puno for the last time on September 28, having thus had nearly six months' work in Peru and Bolivia, most of which time was spent on Lake Titicaca itself, though we visited various other places in the neighbourhood to make collections for comparative purposes.

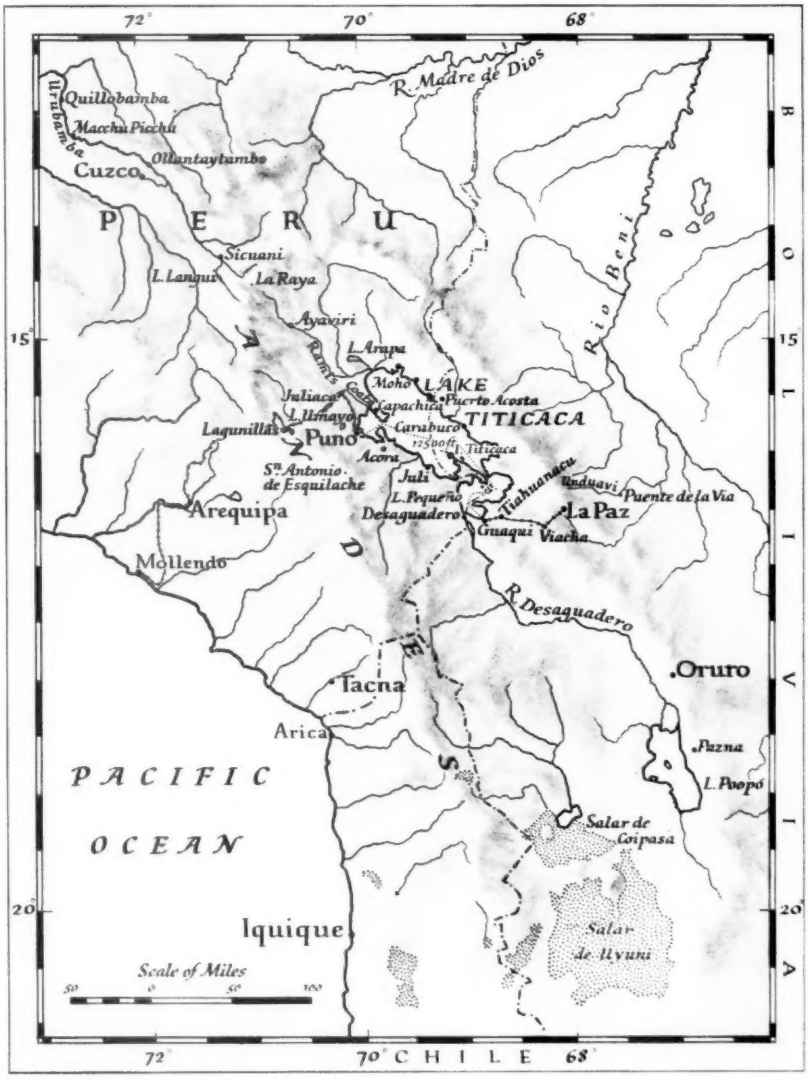
Lake Titicaca lies in lat. 16° S. at an altitude of 12,500 feet above the sea on a plateau in the middle of the Andes, where the range divides in the southern part of Peru into two main ridges which reunite farther to the south. About two-thirds of the lake are in Peru and one-third in Bolivia. It is tectonic in origin, having been probably formed in the Eocene period by a sinking of the central part of the original Andean chain. Somewhere about this time the present mountain ranges were thrust up on either side and walled in the central plateau. The lake has thus a fairly long history, though not as long as Lake Tanganyika or Lake Baikal, and it has not now, and probably never has had, any connection with the sea. In spite of the fact that its basin is an area of inland drainage Lake Titicaca is fresh, though its water has a rather high salt content for fresh water. The lake retains its freshness partly because it is fed mostly by melting snow in a comparatively small catchment area, but mainly because some at least of its water drains away to the south by the Rio Desaguadero into Lake Poopó; the reason for the comparatively high salt content is that the Desaguadero carries away only a part of the water, the remainder being lost by evaporation to the very dry air. This is supported by the fact that the salt content is slightly higher in the Lago Pequeño (the southern arm of the lake) than it is in the main

basin. Lake Poopó, on the other hand, has no outlet [1] and its water is distinctly salt.

The object of the expedition was to find out as much as possible in the time available about the conditions of life in the lake, the fauna and flora to be found there, and the ecological interrelations between the various elements of that fauna and flora. The travels of D'Orbigny and the expeditions of Agassiz and Garman (1876) and Neveu Lemaire (1906) had already told us a certain amount about the fauna and about the bottom topography of the lake, which is nearly 1000 feet deep at the deepest point. In the deeper parts the few soundings we made agree well with previous measurements. Curiously enough the greatest depth we found (272 metres) is exactly the same as the deepest sounding made by Neveu Lemaire, although in a slightly different position. Nearer the shores we found that the sides of the lake are very much steeper than was previously supposed. From the earlier collections it was known that, as might be expected in a lake which has been long isolated, it contained a number of endemic species of fish (of the carp family) and also of amphipod Crustacea (allied to the sand hopper common on British shores), but nothing was known of the aquatic insects or of the minute floating organisms forming the plankton. The knowledge gained from these earlier researches, and considerations of the lake's type of basin and position, led to the inference that the fauna was probably somewhat scanty. Although individuals were abundant, this inference was fully borne out by the very small number of species found, so that the fauna is not of outstanding interest to the taxonomist. It is nevertheless extremely interesting to the ecologist since the relations between the various elements of the fauna and flora are probably simple enough to be comprehensible, and we hope, when our collections are fully worked out, to be able to give a fairly complete account of these relations. Since a great deal of work remains to be done on the collections and the other data which we accumulated, we are not at present in a position to say more about the strictly scientific results of the expedition.

Titicaca is a large lake, being some 100 miles long and from 20 to 40 miles wide. It is fed by four or five principal rivers in which there is some water all the year round, and by innumerable small torrents which only run in the rainy season. A great deal of the shore-line is steep and rocky, especially along the north-eastern side, but in some places, such as the valleys of the main rivers, there is an extensive flat plain only a few feet above the level of the lake. This is the old lake-bed, a relic of the not very distant time when the lake was 30 or 40 feet higher than it is now. Even where the shores are steep the small bays usually have a rocky entrance and a gently shelving head, which was presumably part of the bay at this time. This type of lake evolution with a falling water-level is seen at a later stage in Lake Poopó. There the lake is extremely shallow (not more than 15 feet deep), and is surrounded by an almost flat margin a mile or more wide between the water's edge and the surrounding hills. On the hills may be seen traces of several

[1] An underground outlet has been postulated for Lake Poopó, but there is no evidence for its existence nor does the postulate appear to be necessary to explain the facts.



Lake Titicaca and the surrounding plateau

An Indian house on the Capachica Peninsula, showing the potato fields and the stooks of barley

Top of a pass near La Paz (15,000 feet): the rough pasture is typical of the upper parts of the altiplano valleys

Small bay on the north-east shore of Lake Titicaca. The flat area was covered by water when the level of the lake was higher

raised beaches showing older levels of the lake. The same process is still further advanced in the salt pans of Coipasa and Uyuni which are almost dry for most of the year.

The immediate surroundings of Lake Titicaca are fairly thickly populated by Indians, the population being densest in the less steep parts where there is water for irrigation. Almost all the land which is not bare rock or impossibly steep is cultivated in small fields which are often extremely steep. Most of these are roughly terraced, though not with anything approaching the skill and elaboration of the Inca terraces to be seen in many places in the valley of the Urubamba near Cuzco. The principal crops are barley (introduced by the Spaniards), potatoes, and *quinoa* (*Chenopodium quinoa*), a plant allied to spinach but grown for its small round grain, which when cooked is not unlike semolina; it is said to be extremely nutritious. They also grow smaller quantities of beans and *oca* (*Oxalis tuberosa*), a sweetish tuber somewhat resembling a potato to eat. Maize and wheat, which has been introduced comparatively recently, are also grown lower down but do not appear to flourish above 11,000 feet.

Before the Spanish conquest the country had no draught animals and the tilling of the soil was apparently all done with a "foot plough," really a primitive sort of spade with an additional lateral handle which can be used either for a hand or a foot. It is interesting to note that except for quinoa, which must have been sown broadcast, all the indigenous crops are things which are planted singly. The foot plough is still used for planting potatoes, but for the grains a simple wooden plough drawn by oxen, which must have come in with the Spaniards, is used. This is not a very effective implement, since it is only in the most favourable circumstances that it will turn over as much as 4 inches of soil, a more usual depth being 2 to $2\frac{1}{2}$ inches. The grains are threshed in a primitive manner with curved sticks (the jointed flail appears to be unknown) and are then winnowed in the breeze by throwing handfuls up into the air. The quinoa is treated early in the season when the wind is light, the barley being kept for the rather stronger breezes of July and August.

The greater part of the potato crop is rendered completely unpalatable to the European by conversion into *chuño*. This is done by spreading the potatoes out on the ground where they are alternately frozen at night and thawed and dried in the sun in the day time. They are also trodden by the women, to remove the skins and aid the drying process by squeezing out some of the water. The final product is not unlike a very light form of pumice stone; the best quality is almost white, but most of it is a dirty grey or black. It appears with great regularity in the soup, where it has no taste that we were able to detect, while its texture is an unpleasant one, something between that of a badly made water ice and an indifferent and very gritty pear. The only advantages possessed by chuño appear to be its lightness and its keeping qualities. Besides being preserved in this way, potatoes are sometimes eaten roasted in their skins. When this is done a special kind of clay called *chacco*, which proves on analysis to be almost pure kaolin, is nearly always eaten with them in the form of a thin creamy paste made up with water, into which the potatoes are dipped.

Although the land near the lake is mainly of an arable character, the Indians there also keep a certain number of animals. A few small horses and mules are used for riding, and donkeys for carrying loads, while small numbers of cows, sheep, and pigs are also to be seen; dogs are innumerable but do not seem to be used for driving sheep. Llamas find the climate here too warm for permanent existence, but flocks of them constantly visit the town to which they bring loads from the higher surrounding country. The scenery in these higher parts away from the lake is characterized by the wide, flat-bottomed, gently sloping valleys through which the upper reaches of nearly all the altiplano rivers flow. These valleys with their sub-alpine vegetation of tussocky grass and small shrubs provide most of the true pasture land of the country, and support large flocks of sheep, llamas, and alpacas, which mostly belong to large haciendas. In the wilder parts above 13,000 feet groups of *vicuñas* wander.

One of the most important natural products of the lake itself is *tortora* (*Scirpus tortora*), a sedge very much like a larger edition of the *Scirpus lacustris* common in European fresh waters. This grows in abundance in all the sheltered parts of the lake where the depth is not more than 10 or 12 feet. One of its principal uses is for thatch for which purpose it is cut and made up on the ground into large mats. These are then rolled up and hoisted on to the roof, where they are unrolled and tied down to the rafters. When the ridge has been tidied up and the whole made secure the result is a fairly good roof, which usually only leaks a little in heavy rain.

Another and more interesting use is the building of the native boats called *balsas*. These are really rafts consisting of huge bundles of tortora tied together with ropes of plaited grass. Smaller bundles tied on top form bulwarks, but the floor of the boat is above the water-line. The balsa is a clumsy craft which is unsinkable, but can be overturned; when the ropes get rotten there is some danger of falling through the middle, or the whole thing may come in half. Two or three men can make one in two days, and the cost to the foreigner is nine or ten shillings. They last from two to three months before they break up, to be washed ashore and eaten by the cows. At the northern end of the lake there are two types of balsa made. A small size 8 to 10 feet long carries one man, who propels it with a pole used as a double paddle; it is used for fishing and never carries sail. The larger type, which may be up to 20 feet or so in length, is used for transport and carries a single matting squaresail made of tortora on a bipod mast; it is also punted or sculled with a single paddle over the stern. The sail is also used as an awning to protect the occupants when in harbour. In the southern part of the lake where timber is more easily available, these large balsas are almost entirely replaced by well-built wooden luggers up to 30 feet long, but undecked. Balsas are however used for fishing, but the Bolivian type is larger and better made than the Peruvian. It has long points at bow and stern, and nearly always carries a small tortora sail, which is almost a lugsail and is supported on a short bipod mast stepped very far forward. Fishing is done from the balsas mainly with nets, and is a considerable industry, the two largest fish, *boga* and *humanto*, being quite good eating. Near the shore fish are also caught in almost globular basketwork traps, made of grass

with an inturned mouth like a lobster pot, which are baited and put down at night. The use of rod and line is apparently unknown to the Indians.

One of the advantages of Lake Titicaca from an expedition's point of view is that the region is fairly civilized. The reason for this is that it lies on the oldest of the railway routes from the coast to La Paz, passengers and goods travelling by rail up to Puno, then by steamer down the length of the lake to Guaqui, and from there by train to La Paz. Puno is therefore a considerable town of some 15,000 inhabitants, and contains the extensive workshops required for the maintenance of the lake steamers. The help so generously given us by the Peruvian Corporation therefore made it easy for us to obtain supplies and maintain the two motor launches we used for our work on the lake. One of these had already been on the lake for some years in the service of the Seventh Day Adventist Mission from whom we bought her. She was a roomy craft 30 feet long with a large cabin containing four bunks and arrangements for cooking, and a large open cockpit aft. She suited our purpose admirably, making cruises of a week at a time possible in considerable comfort, and providing plenty of room for working from. Most of our biological work on the lake was done from her, or by wading in shallow water. The other, a smaller boat 26 feet long and rather narrow in the beam, we took out with us. She was specially equipped for hydrographical work with an electrically driven winch for sounding, making temperature observations, collecting water samples, and dredging and trawling in deep water.

Our base was established in an hacienda on the peninsula of Capachica, which bounds the north side of Puno Bay. The owner was not in residence, so that we had the use of most of the house, while his mayordomo kept house for us as well as looking after the work of the farm. Here we had a dining-room and four laboratory-bed-sitting rooms, in which the collections were sorted and preserved and numerous chemical analyses were performed on the samples we collected from the lake and elsewhere. Life there was fairly strenuous since the little cove where we kept the launches was 3 miles away, but the brilliant sunny days and cold nights made the climate an invigorating one. After the first day or two nobody was seriously inconvenienced by the rarified air, and after a month or so we hardly noticed it, although long-continued violent exertion remained an impossibility. It was pleasant to be able to do a good deal of one's work sitting in the sun in the courtyard, and Sundays usually saw various members of the party reading, writing, and cutting each other's hair in the sun. Milk, eggs, meat, and potatoes were all obtained locally; other articles of food, such as bread, green vegetables, fruit, and groceries, were brought out from Puno in a balsa by an Indian whom we sent in twice a week to collect them.

Entertainment of an interesting type was also to be had occasionally in the village of Capachica in the form of native dances. Most of the Indians are nominally Roman Catholics and advantage is taken of any church festival to hold a *fiesta*. On these occasions they do no work, but spend the day, and sometimes the night too, consuming a good deal of alcohol and dancing at intervals. The dances are of an informal type consisting more of music and curious clothes than of steps, and are performed for the most part by groups

of 10 or 15 people. In the centre of the group is a drummer round whom a number of men process, first in one direction and then in the other, with a curious shuffling step, playing pan-pipe instruments made of a number of bamboo tubes. The music they produce could not be called tuneful to our ears, but it has, nevertheless, a strong but quite indescribable character and rhythm. Outside the ring of pipers are four or five dancers in very various types of fancy dress including fantastic masks and wigs. Many of them wear stiff brocaded tunics containing a great deal of metallic thread, which represent the armour worn by the Conquistadores at the time of the Spanish conquest; others have long flowered frock-coats which presumably represent the Spanish grandees; others are dressed like North American Red Indians, and others wear a nondescript garb crowned by a hideous wig or mask. Most of them wear heavy boots of the type used for mountaineering, and they all move backwards and forwards with much twisting and turning round the band in the same rather slow shuffling step. The women only come in on the outskirts of the group where, dressed in their ordinary best clothes, they execute a series of pirouetting movements, two or three of them usually leading each group of dancers as they move slowly round the market-place. Some groups have in addition three or four youths, dressed in flowered cretonne pyjamas and large straw hats and carrying in their hands strings with balls on them, handkerchiefs, and sometimes sticks, who dance in a more lively running step with much swinging round and flinging of their arms about.

The resemblance of these people's accoutrements to English Morris dancers was carried a stage farther in one fiesta by the presence of some with bells on their legs, but the style of their dance has nothing in common with the stiff jerky movements of Morris dancing. Another curious parallel to our own dances was provided in the Whitsun fiesta by a group of six, two men, two women, and two children, who danced with strings in a manner strongly reminiscent of English sword dancing. These people wore curious ridged hats and carried bundles decorated with tassels on their backs. Their dance differed from the others in being very much more formalized and having definite figures, in one of which the strings were all joined together in the middle and they carried one end in a hand and another attached to a big toe.

The Indians are a race which has been consistently oppressed since the beginning of the Inca regime, but they have so adapted themselves to this condition that they have lost all apparent desire for progress, and this is perhaps their most conspicuous characteristic. They are extremely dirty and not always honest, but they have a lively, if rather childish, sense of humour and are almost always friendly. So long as they can grow enough to provide themselves with food, clothing, and a little cash for alcohol and *coca*,[1] their only luxuries, they are happy and contented.

[1] The dried leaves of the cocaine plant, *Erythroxylon coca*, which they chew habitually.

The mouth of the Rio Ramis at the north end of Lake Titicaca

Lake Poopó, surrounded by flat land which was formerly submerged

Inca cultivation terraces at Pisacc in the Urubamba valley

DISCUSSION

Before the paper the CHAIRMAN (Admiral Sir WILLIAM GOODENOUGH) said: The pre-Inca civilization regarded Lake Titicaca as sacred. Considering its great beauties and the many legends which were attached to it, it is not surprising that they did so. It was said that from the waters of the lake there sprang the first Inca and his wife. For such reasons, apart from anything else, Lake Titicaca has a most romantic interest, increased by the fact that the borders of Bolivia and Peru run right through the lake.

To-night we are to hear from Mr. Gilson something of the waters of the lake and its immediate neighbourhood. The Percy Sladen Trust which sent this expedition out concerns itself mainly with natural history, but with proper breadth they allow geography and all its embracing matters to form part of this research. Mr. Gilson led a party of seven to examine various matters in connection with the lake. What he found and what he saw he will tell us in a lecture which I now invite him to deliver.

Mr. Gilson then read the paper printed above, and a discussion followed.

The CHAIRMAN: We have with us one other member of the expedition, Mr. Crawford, whom I will ask to speak.

Mr. CRAWFORD: As Mr. Gilson has said, we were not by any means the first naturalists to visit Lake Titicaca. The French traveller Alcide d'Orbigny, who went to the region in 1837, spent four years in South America travelling from coast to coast and, alone, he did the geology, botany, and zoology of the region he visited—a rather striking contrast to our modern ideas. He spent a few days by the shore of Lake Titicaca and, hiring a native balsa and in some fear of its waterlogging and sinking, he spent a few hours on the lake and collected two or three small snails. Those were the first collections made. In 1876 Agassiz went from the United States and, with one companion, spent some months by the shore of the lake. He made an excellent collection of the crustacea, fish, birds, mammals, amphibia and, in fact, of most of the vertebrate fauna, aquatic and terrestrial. In 1904 a French archaeological expedition crossed the lake, coming up from Bolivia. They had one naturalist with them, Neveu Lemaire. They hired a steamer on the lake and travelled round it dredging, chiefly in the shallow waters, and making soundings over the greater part of the lake.

We had a good deal of trouble in getting afloat on Lake Poopó. Beyond going about 2 miles from shore and taking water samples and a few collections we did not consider it worth while to go very far because Neveu Lemaire had already spent about six days on it in a little boat which he took up there himself. In fact, if you can conceive of being in danger of shipwreck on a lake which is at most 4 metres deep, that is what happened to him. He was blown over to the far coast. He returned, and I think the sole result of that six days was to show that some five or six kinds of animals live in the lake, which is very saline and contains what one may call the refuse of the fauna of Titicaca.

When we went to Titicaca the main lines of the fauna in the lake had been found. We knew a good deal about the fish and a certain amount about the smaller animals. But several familiar aquatic animals, such as watermites, had never been collected, and even in the groups best known there was a good deal to be done, not only in the collecting of unknown species but in finding the relationship of one species with another, especially in the way of food chains. Every collection of smaller animals was made from the point of view of the type of bottom and the depth at which each lived. In particular there was a great deal to be done in finding the relation between the fauna of the lake and the

fauna of the rest of South America, and of the various small lakes which we were lucky enough to visit besides Lake Titicaca itself. The most interesting of these were the Lagunillas, two small lakes about 100 miles from Titicaca and at 14,000 feet. With the help of the Peruvian Corporation we got a boat with an outboard motor up to these lakes and spent two or three days, chugging around at about a couple of knots because the engine lost a good deal of power at that height, making collections which I think will prove to give a very good comparison. Starting with an examination of Lake Titicaca, with about as much water as the English Channel, and then examining other lakes of the size of Windermere or even smaller, we made collections from which should come interesting comparisons of the effect of different degrees of isolation on the fauna.

So much for the fauna of the lake itself; there is also the fauna of the barren hills that surround it. The whole of South America has a rather curious and impoverished collection of animals to be found in it. The largest herbivore is the tapir, which is about as big as a horse. There is nothing to compare with the elephant of the Old World. The largest carnivores are the pumas and the jaguars. There are no lions or tigers. When you get out of the great forest and on to the Andes the fauna is even more restricted.

The first native animal that strikes one is the llama. The llamas were, of course, before ever the horse or the donkey or later the motor car or trains were introduced, the one method of transport in Bolivia and Peru and all the high ground of South America. In the Inca days there were high-roads along the whole length of the high plateaux and beyond them down to valleys running north and south into the lower ground, on which llama trains were perpetually travelling. You can still see them in little groups of ten or twenty, each carrying a bundle of about 100 lb. It is said that if you load one with more than 100 lb. it lies down and will not carry.

The other native domestic animal in the hills is the alpaca. A little distance, 1000 feet or less, from the lake you enter country which is more austere and colder, but with fairly continuous turf and often a little damp in the ground as you walk. There the natives pasture enormous flocks of alpacas, animals like the llama, with shorter muzzles and wool like sheep. The llama is the beast of burden of the hills, and the alpaca is the wool-producer. The wool is plucked every two years, and as a result of the long period between pluckings, the alpaca just before it is due to be plucked has a curious bearded appearance with hair sticking out in all directions, so that they look like nothing so much as a crested grebe.

It is said that both the alpaca and the llama are domestic forms of the guanaco, which I did not see until we got down to Buenos Aires and then only in the Zoo there. Till recently they occurred up in the Peruvian Andes, but have now been driven farther and farther south by persecution. They are abundant as far south as Tierra del Fuego. I believe many of the Indian races in the southern end of Patagonia depend upon the guanaco for food and clothing.

The other animal of this type is smaller and is said to be quite distinct; this is the vicuña, which we saw in little herds of ten or twenty on the hills. It is smaller than the llama and of a pretty fawn colour. It is very striking that whereas the wild forms, the vicuña and guanaco, are self-coloured, the llama and alpaca are all dappled over with different colours. Apart from these, there are very few animals to be seen. There are a few little lizards and a certain number of butterflies; a lot of little mice of rather a nondescript type, which do not strike the eye; and one rather attractive rodent, the viscacha, which takes the place of our rabbit. It is only to be found in the rockier and wilder places, because it

Peruvian balsas in Puno bay: the large, blunt-ended type with a rectangular sail is used for transport

Bolivian balsa, with a quadrilateral sail, used for fishing only

The Whitsun fiesta at Capachica. Some of the dancers' clothes represent the armour worn by the Spanish conquistadores

String dancers at the fiesta

is quite good food and is apt to get shot by the Indians. It is somewhere between a rabbit and a squirrel to look at, with a very long bushy tail. It lives among the rocks on which it bounds and climbs with great agility.

There is also an interesting variety of birds to be seen in the region of Lake Titicaca. Probably the birds give a better impression of richness at first sight than anything else, certainly to a naturalist. There are a few humming-birds and flamingoes, which are strikingly beautiful. The whole of the bird fauna of the lake is very rich in numbers and even in species. There is a local sort of black-headed gull, the Andean gull, two species of coot, a moorhen, and a variety of waders. I can remember most clearly how, when we were sleeping in our launches in among the reeds on one of our trips, the water birds kept up a whistling and chattering until some time after we had settled down to go to sleep. The birds were a great blessing to us because often we were very short of meat. One or two of the things we ate were rather surprising: the viscacha was one, the guinea pig another. But I think probably what surprised us most, when we found how good they were, were the coot and the cormorant.

The CHAIRMAN: Among those to whom the expedition owed a good deal was Mr. Morris, who was the Minister at La Paz when the expedition started. We are so fortunate as to have him here to-night and I will ask him to say a word or two.

Mr. MORRIS: I was His Majesty's Minister in Bolivia at the time the expedition was proposed, and consequently I had a good deal to do with making the arrangements for it to visit that country. It is therefore with an unusual sense of pleasure that I have listened to Mr. Gilson's lecture, and heard that, although the expedition did not apparently succeed in getting all the information it would have liked, it has been a success.

Englishmen have a traditional dislike of making much of anything they do, and in listening to the lecture to-night I have felt that Mr. Gilson is no exception to this rule: he has given you quite an imperfect and inadequate idea of the difficulties and discomforts with which the expedition had to contend. Had they not been a stout-hearted and enthusiastic party, and had Mr. Gilson himself not been capable of inspiring the expedition, it could not have carried out its work so successfully.

Mr. Gilson has dealt with the scientific and geographical aspects of the expedition, but I cannot help feeling a little sorry, as half Lake Titicaca is in Bolivia, that he did not go a little farther. Perhaps it would have been a little outside the scope of his lecture. Nevertheless, as La Paz, the capital of Bolivia, is only 60 miles from the lake and there you have an unique and interesting town, I cannot help regretting that he has not shown you photographs of Bolivia and La Paz, and told you a little about the curious charm of living at high altitudes. I remember very well, when I was asked if I would like to go out to Bolivia, that I was a little apprehensive with regard to the effect of the altitude and the climate. I had the good fortune however to discover in London one of my predecessors and his wife, and they quickly reassured me. I have visited most of the countries of Latin America, and I think of them all one of the most historically interesting and fascinating is Bolivia. There the sky is always blue. You can wear thick clothes and yet enjoy brilliant tropical sunshine. The air is cold and invigorating. There are no insects to worry you. The scenery, with its curious mixture of tropical vegetation and great snow mountains, is really wonderful. One feels there what James Hilton in the 'Lost horizon' describes as "the ecstatic tranquillity of mind at high altitudes."

The CHAIRMAN: Dr. Louis Clarke tells me that it is thirty years since he was in the neighbourhood we have heard of this evening. We should like to see

whether his memory is sufficiently retentive to make some comparisons between what he saw and what he has heard to-night.

Dr. CLARKE: I have listened with much interest to Mr. Gilson's lecture. When I heard that the expedition was going out, I asked Mr. Gilson and his party if they would collect pottery for the Museum of Archaeology and Ethnology at Cambridge. They have brought back a number of sherds and also the greater part of a very fine beaker, which, now that it is restored, is probably the most remarkable piece of pottery from Bolivia in any museum in this country.

It always seems strange that a country so arid as that all round Lake Titicaca should at one time have been the centre of such a wonderful civilization and of an art of such a distinctive style. At Tiahuanaco there are very fine ruins to be seen. The most important of these is the great monolithic gateway, the chief decoration of which is a man with a square head holding a baton in each hand. This motive has spread far to the West, where it is a common design in the art on the coast of Peru, though not so much on the pottery as on the textiles. To-day when one goes to Titicaca and sees a terribly barren region, one cannot help wondering why at one time there was such a large population there.

The CHAIRMAN: This is not the first occasion on which one says: Here is something which has raised new interests, something one wants to know more about and to read about. I do not know whether Mr. Gilson is going to write a book; I have no doubt he is likely to do so. I do not mean only a record of the results of his scientific inquiries but something of a more general nature, something as to the impressions he and his companions got from mixing with peoples, about whom we, after all, do not know much.

Mr. Gilson has shown, as all these comparatively young men do, great resource and great perseverance. I say "comparatively young men," because I so often hear people say: "How wonderful it is that these young men do so much." They are not young men at all. They are grown men of experience, and we can learn a great deal from them. I hope that Mr. Gilson will prosecute his researches, make fresh travels, and come here to give us the results of his experience and probings.

I invite you all to show, in the usual manner, your appreciation and thanks to Mr. Gilson and his companions for giving us a very interesting evening and the prospect of hearing more when his researches are published.

DRAKE'S PLATE OF BRASS

J. A. WILLIAMSON

IN the summer of 1579 Drake visited the coast of California in the course of his circumnavigation of the globe. At a bay which has not been strictly identified he remained for a month to refit. He named the country New Albion, and set up a plate of brass (or, by another account, of lead) with an inscription recording its annexation to the Crown of England. In this plate a hole was cut to admit a sixpence of current English money, bearing the image and device of Queen Elizabeth. The records of the voyage do not give the actual words of the inscription, but only its purport.

In June or July 1936, a young man named Beryle Shinn, making a holiday excursion at Corte Madera Creek, an inlet of the Bay of San Francisco, picked up a dilapidated piece of brass measuring roughly 8 inches by $5\frac{1}{4}$ inches, and $\frac{1}{8}$ inch thick. He thought that it might be useful and placed it in his car. Examining it some time afterwards, he saw that there were letters on its surface, cleaned out the dirt which clogged them, and was able to read some words, one of which was DRAKE. Mr. Shinn knew little or nothing about Drake and his voyage, but a friend advised him to show the plate to Professor Herbert E. Bolton, of the University of California. This he did in February 1937. Professor Bolton had made a study of all the evidences of New Albion, and had for years been urging his students to look out for Drake's plate. Mr. Shinn, although not one of his students, was thus directed to a man who could well appreciate the importance of the discovery; and, when the whole inscription had been deciphered, it appeared to be of the first importance.

No sooner had this become public by reports in the press than another finder of the plate came forward. William Caldeira, a chauffeur, stated that he had picked up the same piece of brass in 1933 at Drake's Bay, farther to the northward. He had kept it for some time, and had then thrown it away at the spot where Shinn afterwards found it. His statement was corroborated by his employer, to whom he had shown the plate at the time, as he had noticed that it appeared to bear an inscription.

Professor Bolton quickly became convinced that the plate was veritably that set up by Francis Drake in 1579. A number of public-spirited men subscribed a sum of money with which to buy the relic from Mr. Shinn, after which it became the property of the University of California. The purchasers have not disclosed the amount of the price, but a newspaper says that it was $3500. Whether or not that is correct, the purchasers have stated that they themselves fixed the amount which they thought suitable and that the finder did not suggest a price or haggle in any way.

Discussion soon arose on the genuineness of the plate, for there was obviously a possibility that it might be a fake, more especially as Professor Bolton had long been stimulating interest in the subject. It is quite clear that the faker, if there was one, was not Mr. Shinn, whose character is vouched for, and who has not the knowledge requisite for composing the inscription. Moreover, if Mr. Caldeira is right in supposing that the plate he found was

the one now in question, the date of the forgery is put back some years, and the culprit did not take pains to "plant" it in such a way as to secure financial gain for himself. But the apparent absence of material motive is not conclusive. Such things have been done out of sheer mischief.

The plate bears the following inscription:

BEE IT KNOWNE VNTO ALL MEN BY THESE PRESENTS
IVNE.17.1579.
BY THE GRACE OF GOD AND IN THE NAME OF HERR
MAIESTY QVEEN ELIZABETH OF ENGLAND AND HERR
SVCCESSORS FOREVER I TAKE POSSESSION OF THIS
KINGDOME WHOSE KING AND PEOPLE FREELY RESIGNE
THEIR RIGHT AND TITLE IN THE WHOLE LAND VNTO HERR
MAIESTIES KEEPEING. NOW NAMED BY ME AN TO BEE
KNOWNE VNTO ALL MEN AS NOVA ALBION.
G[or C] FRANCIS DRAKE[1]

The letters have apparently been incised with some tool like a cold chisel, the execution is rough, the lay-out crude, and the general effect is not that of skilled craftsmanship. Towards the bottom right corner is a jagged hole which may have framed the sixpence, but the latter has not been found.

The question of genuineness at present turns on the evidence provided by the plate itself. Various details in the inscription have been challenged, but in the present writer's opinion the only serious difficulty is in the spelling HERR, occurring three times. He cannot recall ever meeting with this spelling in an Elizabethan document, although the word is so common that he must have seen it many times in the writings of the period. At first sight this word HERR appeared to condemn the inscription as spurious, but on reflection it seemed to point with equal force in the contrary direction. If the forger was sufficiently competent to evolve an inscription which in all other respects of spelling and phrasing is unexceptionable, why should he make a blunder so elementary? On the whole it seems just as likely that the word HERR was so spelt by an Elizabethan as by a pseudo-Elizabethan. Ventilation of this point may well have the result of producing some authenticated example of "herr."

Another suggestion raises a consideration that has yet to be cleared up. It is stated by Californian critics that sixteenth-century brass is chemically distinguishable from present-day brass, owing to a difference in the process of extracting zinc; and that if the plate is a piece of modern brass, a test will reveal the fact. The guardians of the plate have made some inquiries, but

[1] The inscription is here given as reproduced by Professor Bolton in 'Drake's Plate of Brass' and amended by Mr. Allen L. Chickering in *California Historical Society Quarterly*, Sept. 1937, p. 278. It will be noticed that FOREVER is the modern American form. In the original many of the words are so crowded that the separation between them can only be deduced from the sense. There is no apparent separation between FOR and EVER. In the penultimate line AN (for AND) is as in the original.

have not yet found any one who will undertake to make such a test. The matter can obviously be taken further. Meanwhile they are, of course, quite right not to allow experiments until it is established that all early brass is distinguishable from all modern brass, and that advice from a perfectly competent expert is available.

[*Authorities*: 'Drake's Plate of Brass,' California Historical Society, San Francisco, 1937; articles by R. B. Haselden and Allen L. Chickering in *California Hist. Soc. Quarterly*, September 1937; a photograph of the plate seen by the writer; and press cuttings and other information transmitted by Dr. Fulmer Mood, of Berkeley, California, to whom the writer's sincere thanks are due.]

REVIEWS

EUROPE

THE INNER GATE: a regional study of north-west Kent. By E. H. CARRIER. *London: Christophers*, 1937. 8×5 *inches;* x+136 *pages; illustrations and maps.* 3*s* 6*d*

The regional survey movement in education and local geographical research, which have had so wide an influence during the present century, have brought forth a crop of studies of small regions, comparatively few of which have reached the stage of publication. It is not stated that this book originated in such a thesis, but it gives one that impression. As such it would have considerable merit, but as a serious regional study of the area in question it falls somewhat short of present-day standards. The examiner of a thesis can, and indeed must, overlook minor inaccuracies. Unless he is very familiar with the ground he may not even detect them. In any case he knows that, with the short time at his disposal, the student cannot gain an intimate personal acquaintance with the region.

The case is, or should be, different with an essay intended for publication in book form. In the present instance the author has been at pains to gather together a mass of information relating to north-west Kent from various sources, some of which are mentioned in the meagre and curiously selected bibliography. There is however little evidence of the intimate first-hand knowledge of the country under survey, or of some of the subjects dealt with, which is the first essential for fruitful regional research. The author has made a brave attempt to deal with the geology and surface features of the district in three of the four chapters on "Environment," but one feels that the non-geological reader will not gain from them a clear understanding of this important aspect of the subject. The geological structure of the district lends itself admirably to clear demonstration by means of geological sections, but these are entirely absent. This is the more remarkable in that the author, in the chapter on "Suggestions for personal investigation" exhorts the reader to "gain practice" in making them.

In the chapter on "Climate and scenery" the author would have avoided many errors by consulting a plant ecologist. There is for instance the statement that "Keston Common contains much natural bog with rare bog plants, but in general these wastes are beautiful with gorse, heath, bracken, briar, wild flowers and, in places, firs, larches and junipers." There are certainly pines in plenty on the wastes in question, but the more characteristic trees are the birch and the sessile oak which are not mentioned in this connection, although there is an excellent photograph of a birch grove. There are a few square yards only of bog on Keston Common and its plants, though interesting, are by no means rare.

The book opens with a readable chapter on the Roman Road (Watling Street). The fact that this ancient way traverses the northern part of the area *en route* to London, and that another ancient track, the Pilgrim's Way, traverses the southern part, though not towards London, has determined the author's choice of the title of the book. This however is not what gives to the region such unity as it has. The area as a whole is better regarded simply as a sector of the northern flanks of the Wealden anticline.

The remainder of the book comprises four chapters on economic geography and three on historical geography. There are a number of excellent photographic illustrations mostly taken from *The Times*, but only two small and rather poor maps of geological and surface features. C. C. F.

A HISTORY OF RICHMOND PARK: with an account of its birds and animals. By C. L. COLLENETTE. *London: Sidgwick and Jackson*, 1937. 10×7½ *inches;* xii+164 *pages; illustrations and map.* 7*s* 6*d*

Richmond Park was first enclosed by Charles I, who purchased the private lands, took over from the surrounding parishes the common lands, and surrounded the whole by the retaining wall which is still in existence. These walls were completed and the first Ranger was appointed in 1637. From that date it remained in the hands of Rangers directly appointed by the reigning monarch until 1904, when King Edward VII entrusted the whole care of the Park to the Commissioners of Works for the benefit and recreation of the public.

Mr. Collenette's volume deals with two distinct aspects of the park. The first half is devoted to the history not only of the park itself, but of the houses, gates, plantations, and ponds, and is illustrated with some excellent photographs taken from the air and a good map reproduced from the Ordnance Survey. The second half contains a carefully compiled and annotated list of all the birds and mammals known to have been observed in the park. As Mr. Collenette has been for some years past the official observer appointed by the Commissioners of Works he has had every opportunity of adding to and amplifying previous accounts. Out of a total of 132 species of birds recorded, 80 may be considered of regular occurrence and 59 as breeding fairly regularly. Considering the large crowds of visitors frequenting the park these numbers seem remarkable, but it must be remembered that there are a good many enclosures which form sanctuaries not open to the public, though often visited and inspected by Mr. Collenette. As regards the deer there is no doubt that they were numerous in this district before the enclosure, as there is historical evidence that Henry VIII used it as a hunting ground when it was known as Sheen Chase. The deer at the present time number about 300 fallow and 80 red.

This is a very pleasant volume which we can highly recommend to all lovers of Richmond Park. It contains much valuable and instructive information and is invaluable to all those interested in the bird life of the Park. W. L. S.

WHARFEDALE. By ELLA PONTEFRACT and MARIE HARTLEY. *London: J. M. Dent & Sons*, 1938. 8×5 *inches;* xvi+230 *pages; illustrations, plan, and sketch-map.* 6*s*

This book, which follows closely on the lines of the authors' 'Swaledale' and 'Wensleydale,' covers less ground than the title implies, for it deals only with that part of Wharfedale which extends from Cam Fell to Bolton Bridge. This is "purely dale country" of which the authors seem to have explored every nook. Their method is to follow the rivers downstream and to describe the villages, and in some cases the individual farms, as they come to them. In dealing with a limited area this method can be highly successful, as it is in this case where the writers know the dale and its people intimately, and are prepared to interpret as well as to describe. They show the scenery of the dale changing from the wild stretches of Cam Fell with its remote "outside farms" to the mellower woods and fields of Bolton Abbey. They show, too, much of the life of those grey villages which give some sense of continuity to the changing scene.

The authors are not content to describe the present; they reconstruct a great deal of the past from the remote days of the cave dwellers to the decline of industry in the nineteenth century. The dale had once a dual character, for it was industrial as well as agricultural. Industry consisted largely of lead mining and cloth making, both of which are described. Little is said of the spinning side of cloth making which must have employed many of the women and girls

of the dale, for it took about half a dozen spinners to supply the yarn for one handloom weaver and spinning was peculiarly a female occupation. Both the lead mining and the cloth making have disappeared, and the dale depends now upon agriculture and to a lesser extent upon catering for tourists. Agriculture it has always had, and it is interesting to note how many of the farm houses were built or rebuilt in the seventeenth century when farming apparently enjoyed a prosperity which merits further investigation.

'Wharfedale' is far more than a guide book. It must be recommended to all who propose to visit the dale and to capture something of its spirit as it is captured in these pages. The photographs are adequate and Miss Hartley's wood-engravings admirable. T. S. W.

L'ÉVOLUTION MORPHOLOGIQUE DU BASSIN DE L'ARDÈCHE. By P. B. VERMEIJ. (Geogr. geol. Meded. Physiog.-geol. Reeks. No. 15.) *Utrecht: N. V. A. Oosthoek*, 1937. 12×9 *inches;* 78 *pages; illustrations and map. Fl.*3

The greater part of this work may best be described as a critical review of the conclusions of H. Baulig in 'Le Plateau Central de la France et de sa bordure mediterranéenne,' 1928, in so far as concerned with the Ardèche basin. Most readers will find difficulty in discerning in it an important positive contribution to geomorphology; for neither in its content nor in its mode of presentation is it a constructive work. Unfortunately it is impossible to indicate in a brief review the many points upon which the author disagrees with Baulig, since detailed topographic references would be essential. It would appear that he has devoted intensive field study to the collection of his evidence; and geomorphologists who have the opportunity of following him to this corner of the Central Plateau will perhaps do well to reread Baulig in the light of these criticisms. To those who are less technically interested the author's thirty sketches may be commended for examination along with the topographic map. A. G. O.

GEOGRAPHISCHE LANDESKUNDE WESTFALENS. By KARL RÜSEWALD and WILHELM SCHAFER. *Paderborn: Ferdinand Schöningh*, 1937. 9½×6 *inches;* 190 *pages; illustrations and maps. M.*4.90

This book is a systematic geography not of the Prussian province (as the title might suggest); but of the "land of Westphalia." The distinction is considered in the first chapter, in which the authors endeavour to define the "historical" and "geographical" Westphalia, and to relate both to the present province. By any geographical definition, they point out, Westphalia is a composite or "transition" region, embracing parts of the North German Plain and the *Mittelgebirge*, as well as straddling the Rhine–Weser watershed. Thus in no sense is it a coherent physical entity. The historical Westphalia is equally elusive. The application of the name has fluctuated considerably, and for some centuries before 1815 there was no state or province of that name at all. Revived after 1815 by the Prussian power, the present province lacks certain smaller states to the north-east (Detmold, Osnabrück, Bentheim) included in mediaeval Westphalia. But they go on to state that neither the present province, nor the historical Westphalia, accord with the geographical Westphalia; which, as the content of later chapters reveals, is simply the country between the lower Rhine and the middle Weser, with a slab of the Sauerland upland. In short, we are provided with an example of the difficulty of bringing political divisions into relation with physical geography. But, oddly enough, the present province does provide an illustration of how modern industry, in

exploiting new resources, renders older administrative boundaries obsolescent, for the south-western limit of the province bisects the Ruhr coalfield.

From this slightly uncertain start the authors proceed to their main task—systematic geography. Dividing Westphalia into physical regions, they take each in turn, and write accounts which are remarkably balanced, detailed, and thorough. It is extraordinary how much information has been packed into these pages; and no topic of consequence has been omitted. The authors evidently share a passion for facts; and are content to present them unadorned. The book will not be attractive to a reader liking well-diluted science; but a student beginning a serious study of German geography will find here a very good text-book on an important area. The latter class of reader, if without full command of the language, will find the simple style allows of rapid perusal.

J. H. G. L.

ÖSTERREICHISCHE VATERLANDSKUNDE, FÜR DIE ACHTE Klasse der Mittelschulen. By HERIBERT NAGLER, RUDOLF ROSENKRANZ, and HANS SLANAR. *Wien and Leipzig: Deutscher Verlag für Jugend und Volk*, 1938. 9×6 *inches;* 278+48 (*plates*) *pages; illustrations and maps. S.*8

This charmingly written school book affords a somewhat melancholy pleasure for those who have witnessed the complete break with a glorious tradition and the final surrender of that position of leadership which Austria enjoyed for so long a period. At least half of the book is devoted to the historic evolution of Austria. The development is first of all traced from prehistoric through Roman times to the new rise of civilization in the Middle Ages. Then follows an interesting account of the development of the cultural landscape of that period, and later there is a chapter on the changes which took place in it during the sixteenth and seventeenth centuries. The development of Austria as an outpost of Christian and "European" culture against the invaders from Asia is also traced in considerable detail, together with Austria's gradual assumption of the leading position in regard to the German people. In view of the shrinkage of Austrian territory and prestige in recent years, the school-boy reader is exhorted to remember the glorious cultural and Christian traditions of Austria, and to recollect that from Greek times onwards the small countries have often made the greatest contributions to humanity.

The account of the present-day geography of the country is also readable and clear, but is subordinate to the historical aspect. The excellent photographs illustrate both the cultural landscape and also objects of historical interest.

M. R. M.

PROFANE PILGRIMAGE: wanderings through Yugoslavia. By LOVETT FIELDING EDWARDS. *London: Duckworth*, 1938. $8\frac{1}{2}\times5\frac{1}{2}$ *inches;* 292 *pages; illustrations and railway-map.* 10*s* 6*d*

The author, who lives in Belgrade, has described a journey which carried him the length and breadth of Yugoslavia. He set out down the Danube as far as Prahovo and through the Timok country to Niš. From there he went south by Skoplje to Gradsko and Bitolj. He crossed the Šar planina to Prizren, and then up to the Sanjak of Novi Pazar before turning through Bosnia to the coast at Kotor. He travelled up the Adriatic and returned to Belgrade *via* Zagreb. For such a journey his title is singularly misleading. The manner of it was normal—mostly by bus; and the author knows the language and culture of the country he is visiting. Except where Albanians are concerned, he has an open and uncomplaining mind. The writing is competent, and the writer observant and concerned as much with people as with ancient monuments. It is in fact the

first book for some time which is likely to be of use to any one visiting Yugoslavia; in this connection it is a pity the map is inadequate. It might encourage the summer visitor to turn inland and learn something about the various regions, other than Dalmatia, of which the country is composed, and to observe, before they vanish for ever, such remnants of the past as the Turkish *čifluk* at Bardovci.

J. P. H. M.

DAS LAND KAMÂL ATATÜRKS: der Werdegang der modernen Türkei. By AUGUST RITTER VON KRAL. Zweite, vollständig umgearbeitete . . . Auflage. *Wien-Leipzig: Wilhelm Braumüller*, 1937. 9×6 *inches;* xii+344 *pages; map. M.*9

TURKEY IN PICTURES. *Ankara: The General Direction of the Press*, [1938]. 10×13¹₁ *inches;* 154 *plates*

This is a second and enlarged edition of a most interesting study of political, economic, and social conditions in the modern Turkish State. Herr von Kral, who is a retired Austrian diplomat, spent many years in Turkey both under the old and the new regime, and is thus able to gauge the value of the reforms introduced by the republican government. His object in compiling this volume was to help to dispel prejudices and rectify misconceptions by giving an impartial account of what the reformers have achieved. He assures us that all the reforms have been most willingly accepted, but there are undoubtedly still many strict Muhammadans to whom the religious ones must be highly distasteful.

The author lays special emphasis on the fact that, unlike the other States which have come into being since 1918, modern Turkey is not a direct result of the Great War: "She became what she is to-day spontaneously, by her own energy." In a short historical survey, Herr von Kral relates the political and military events which led up to the overthrow of the sultanate and the proclamation of the republic, followed within a few months by the abolition of the caliphate. Analysing the new regime, he suggests that it is by no means a dictatorship in the true sense of the word: "Atatürk has never acted without a National Assembly and a responsible government." Nevertheless, Atatürk's personal influence is very great, and to his talent as a statesman and organizer must be ascribed, in large measure, the far-reaching reforms which have taken place. His anxiety to give his country a truly European culture seems to have left nothing untouched; even Turkish music is to lose its oriental character, as we are told in an interesting chapter on the cultivation of the fine arts. Examining Turkey's foreign policy, the author shows that while Turkey is anxious to entertain friendly relations with every country, she is determined to avoid any alliance that might compromise her independence. To become involved in a war would be disastrous to her plans for reconstruction. A chapter on her system of national defence gives some interesting figures of her strength on land, on sea, and in the air.

The section dealing with Turkey's financial position, her system of taxation, the construction of highways, bridges, and railways, and the development of agriculture, industry, and trade covers many pages. It contains some interesting statistics which point to an increasing prosperity. Not only has Turkey become to a large extent self-supporting, but she is now able to export wheat and other commodities which formerly had to be imported in order fully to supply the needs of the home market. To-day her railway system consists of some 6300 kilometres, whereas the figure was 1378 kilometres in 1925.

A carefully compiled index renders this book of facts and figures suitable as a work of reference.

'Turkey in pictures' is an album of large and artistic photographs showing

side by side some of the world-famous architectural gems of which Turkey is still so justly proud, and some of the achievements of the new regime. The views of Ankara give a good idea of the extraordinary metamorphosis which is rapidly shaping it into a modern city on entirely European lines. The ultra-modern architecture of the new capital, the surprising development of industry, and the various aspects of social life portrayed in this collection of photographs all proclaim, more eloquently than any words could do, the fact that Turkey has definitely taken her place among the western nations. F. M. M.

ASIA

JUNGLE TRAILS IN NORTHERN INDIA. By Sir JOHN HEWETT. *London: Methuen & Co.*, 1938. 9×5½ *inches;* 278 *pages; illustrations and sketch-map.* 12*s* 6*d*

Sir John Hewett is a mighty hunter of tigers, and they are the main subject of his book. But in addition there are touches of autobiography, sketches of different types of scenery, notes on the habits of Indian races, and adventures that have happened to Sir John's friends.

The scene is in northern and central India, partly in the plains, partly in the Himalaya. Numerous hunting expeditions are described, and many an incident or adventure related before the tiger is finally shot. There is also much about the habits of tigers. We are told, for instance, of the man-eater of Naini Tal which in seven months accounted for twenty-five victims. But this was mild compared with a man-eating leopard, known as the "Rudraprayag pest," which killed 125 human beings within a period of seven years. Sir John also deals with the technique of hunting. He tells how to manage a beat for a tiger, and discusses the relative dangers of shooting on foot, from an elephant, in a machan, and over a kill. The vexed question of the measurement of tigers is considered. Sir John can here speak with authority, for he has a record of every tiger seen killed, carefully measured and set down at the time. Also he gives interesting figures on their weights. He had a special machine made for the purpose and was able to weigh some good tigers with it.

Of other kinds of wild life, snakes seem specially to interest Sir John. He gives several accounts of adventures with hamadryads. He is absolutely certain that a snake-charmer has the power to lure wild poisonous snakes from their lurking-places. Another such doubtful subject is the problem of wolf-children, and to this Sir John gives similar credence. He believes in their existence and offers an explanation for it. A male wolf, he thinks, may carry a child to the den and deposit it amongst a litter of cubs. The child, if not eaten quickly, will become saturated with the wolf-smell and as a result will become indistinguishable from the cubs.

The book ends with a journey to Leh, written in a pleasing and humorous manner by Sir John's daughter (Mrs. Atkinson). R. W. G. H.

EXCAVATIONS AT TEPE HISSAR, DAMGHAN. By ERICH F. SCHMIDT. (Publications of the Iranian Section of the University Museum, [Philadelphia].) *Philadelphia: University of Pennsylvania Press*, 1937. 12½×9 *inches;* xxii+478 *pages; illustrations and plans*

This is a detailed report embodying the results of two seasons' (1931–1932) excavations under the leadership of Dr. Erich Schmidt at Tepe Hissar near Damghan in northern Iran, one of the many projects of exploration undertaken in that country under sanction of an act of the Iranian Government passed in 1930. Damghan had been regarded by many as probably marking the site

of the Hekatompylos of the Greek historians of Alexander. It is of interest to learn that a test excavation made by Dr. Schmidt led to the conclusion that "no pre-Islamic remains of consequence (certainly not Hekatompylos) are below the present town of Damghan" (p. 16). On the other hand the material recovered from the Tepe Hissar mounds, to which attention had previously been directed by Ernst Herzfeld, carry us back to remote prehistoric times, as far as the 5th millennium B.C., and can be correlated with finds from other prehistoric sites in Mesopotamia, Elam, and Iran, and from Anau and Turung Tepe in the Turkoman steppe. The results of the second season's excavations have enabled Dr. Schmidt to revise some of the conclusions drawn from the first year's operations, and to formulate a much more precise chronology of the site. The three principal strata have now been divided into three, two and three sub-layers respectively, representing eight cultural periods in all. A systematic description and analysis, illustrated by no fewer than 177 excellent plans, figures and graphs, and 79 plates (4 in colour) has been given of all the remains found, layer by layer, under appropriate headings, *e.g.* building remains; pottery; seals; beads; metal, stone, clay, bone and horn objects; and skeletal remains. Here we have a very important register of carefully classified and pictured material ranging from the period of Susa I down to about the end of the copper age, which must prove invaluable for the comparative study of early Iranian archaeology. Sections IX and X are devoted to a description and hypothetical reconstruction of a Sasanian "palace," the remains of which—the first Sasanian structure to be found in northern Iran—were uncovered in an adjacent mound. The volume is very fully indexed.

One peculiar feature of this site is the great predominance of male over female skeletons. In the 1637 skeletons recorded, the proportion of males to females is roughly as 2 to 1 in all the strata except one (IIB), in which it is fairly normal. Many interesting questions of cultural and ethnic contacts and chronological correlations (see Sec. VIII and chart on p. 320), which are outside the scope of this *Journal*, must be left to specialists, who will find abundant material for detailed examination in this admirable report. C. E. A. W. O

KAFIRS AND GLACIERS: travels in Chitral. By R. C. F. SCHOMBERG. *London: Martin Hopkinson*, 1938. 9×5½ *inches;* 288 *pages; illustrations and map.* 15*s*

This is the fourth in Colonel Schomberg's series of admirable monographs dealing with the Indian border countries. Apart from its excellent descriptions of the mountains and glaciers of Chitral, the bulk of the present volume is devoted to an account of the pagan Kafirs, or "Unbelievers" as the name implies, who are fast being converted to the Muslim faith. It is strange, in a country that has been more or less under British control for the last forty years, that no one should previously have described the customs of these most interesting people. Sir George Robertson's classic, 'Kafirs of the Hindu Kush', deals only with the so-called Red Kafirs, whereas Colonel Schomberg has devoted himself to the Kalash or Black Kafirs. The Red Kafirs have long since ceased to exist as pagans; and it is indeed fortunate that so observant a traveller as the present author has seized the opportunity to make a record of the Kalash, before they too succumb to the entreaties of the Mullahs.

Colonel Schomberg makes a number of pungent criticisms of the internal administration of Chitral, which are apt and timely; and it is encouraging to read that he expects many of the worst abuses to disappear under the rule of the new Mehtar, Captain Nasr-ul-mulk, a man of considerable education and experience. It is however more open to doubt whether any ruler, however

enlightened, can do anything to eradicate the innate laziness of his subjects, which seems to be the root cause of much of the trouble. Colonel Schomberg considers that the Government of India has in the past done too much for Chitral, and points out that had the British not intervened in 1895 the country would have become Afghan territory, and would now cost its suzerain a mere few thousand rupees a year.

This is an excellent book, well illustrated and produced. The map, on a scale of 10 miles to the inch, is of great service in following the author's routes, and contains every place mentioned in the text. C. J. M.

[GEOLOGY OF SIBERIA. Vol. II. Middle and Upper Palaeozoic.] By V. A. OBRUCHEV. [In Russian.] *Moskva and Leningrad: Academy of Sciences*, 1936. 10×6½ *inches;* 365–772 *pages; illustrations and maps, plates XIII–XXV.* 15 *R* (*binding* 2 *R.*)

It is hardly necessary to recall here the extensive geographical investigations, and the geological research work in particular, carried out by V. A. Obruchev in various parts of Central, East, and North Asia during a period of nearly half a century (*cf. Geogr. J.*, 70 (1927) 490; 81 (1933) 449; and 86 (1935) 422). The present book is the second instalment of his large Geology of Siberia still in progress, of which the first volume dealt with Devonian and lower Palaeozoic. The new volume is devoted to middle and upper Palaeozoic, and the three chapters forming its bulk are concerned with the Devonian system, with the upper Palaeozoic Coal Measures and Permian, with dislocation and erupted layers of Variscan, and with the useful minerals of middle and upper Palaeozoic.

The present volume is by no means a self-contained part of the work. Indeed, more than one-fifth of it is composed merely of supplements to the five chapters in vol. I, dealing with Devonian and lower Palaeozoic. The reasons for adopting such a method are given in the preface. Its main purpose was to avoid the delay which would have been caused by inserting the vast materials accumulated by the time the proofs of the first issue were read. This applies as well to a number of plates published in vol. II.

The extent of these additions is evidence of the rapidity with which geological studies in Siberia are progressing, which is the more striking in view of the deficiency of some of the local institutions in publishing the results of their investigations. Besides affecting the method of publication, the difficulties encountered by the author in obtaining materials hampered his work in a more essential respect as well, for he was forced to treat his subject unequally from a geographical point of view. As a rule there was infinitely less information from East Siberia, and from the Far Eastern region in particular, than from West Siberia. It proved also impossible to publish a special geological map of Siberia as originally intended. But, according to the preface, an attempt may yet be made to provide an adequate map for the final instalment. It would undoubtedly be of great value if an English summary of the entire work could be supplied as well. L. L.

KÜHLES GRASLAND MONGOLEI: Zauber und Schönheit der Steppe. By WALTER BOSSHARD. *Berlin: Deutscher Verlag*, 1938. 8½×5½ *inches;* 216 *pages; illustrations and maps. M.*6.80 (*unbound M.*5.60)

Mr. Bosshard, a journalist residing in Peiping, made, during the years 1934 to 1936, a series of holiday excursions into Inner Mongolia. He meets, and gratefully acknowledges the assistance of, Larson, Söderbom, Eriksson, and Oberg, the Scandinavian pioneers, who, as missionaries and traders, have done so much for the development of this region and who initiated him into the customs

and politics of the Inner Mongols. He visits Prince Tê, the leader of the Inner Mongol independence movement; and Pai-ling Miao, where the Autonomous Government of Inner Mongolia was for a brief period established; and Dolon Nor, on the borders of Manchuria, where he finds the Japanese digging themselves in. The chief interest of the book, apart from the author's descriptions of the "charm and beauty" of the "cool grasslands of Mongolia," lies in his account of the penetration of Inner Mongolia by the Japanese. On his earlier trips the region is still more or less under Chinese influence, and Prince Tê explains that he and the Inner Mongols are prepared to remain loyal to China if the Chinese Government will agree to their reasonable demands. The later excursions are made in 1936, when Mr. Bosshard finds the Japanese flooding into Kalgan, where they are busy establishing a concession, building an aerodrome and constructing a heroin factory; while Prince Tê, for reasons which Mr. Bosshard fails to elucidate, has thrown in his lot with the Japanese. Since then the canvas has been repainted by the invasion of North China by the Japanese; another Inner Mongol Government has been created, but under Japanese control instead of Chinese influence; and Inner Mongolia has been extended southwards to include the Kalgan to Pao-t'ou railway line, as well as Kalgan, Kwei-hwa-ch'eng and other Chinese border towns; all of which seems like some monstrous dream, from which there must surely be sooner or later an awakening.

From what he says in the preface it appears that Mr. Bosshard has travelled widely in Eastern Asia and made journeys of greater interest than those recorded in this book; notably his flight with the first Eurasia air mail from Peiping to Manchuli.

The photographic illustrations are excellent; and there are two sketch-maps, which show the region in which he travelled, but not the routes taken by the author. E. T.

CHINA'S FIRST MISSIONARIES: ancient Israelites. By the Rev. T. TORRANCE. *London: Thynne & Co.*, 1937. $7\frac{1}{2} \times 5$ *inches; 126 pages; illustrations. 3s 6d*

The author of this book deserves our gratitude for the pioneer work he has done among the Chiang people. He is our only authority on the customs of an interesting tribe and the present book gives us much material of importance, which students of ethnology will desire to possess.

The author however is a missionary rather than a scientist and sets out to prove that the Chiang are the descendants of the lost tribes of Israel. His argument suffers by trying to prove too much and in the end we put down the book with the consciousness of his failure. Nevertheless the interest is maintained throughout and it was well to emphasize that while racial movement has almost invariably been from east to west, cultural movements have worked from west to east. There are definite traces of Jewish or Hebrew settlements in China, and it may be the Chiang have been influenced by them. Strange parallels are however inadequate to prove consanguinity of race, or even contact, and on this rock Mr. Torrance's theory has broken itself. H. H. W.

AFRICA

LAW AND AUTHORITY IN A NIGERIAN TRIBE: a study in indirect rule. By C. K. MEEK. *London: Oxford University Press*, 1937. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xvi + 372 *pages; maps. 17s 6d*

The large if loosely organized states of the eastern provinces of Southern Nigeria, which have provided the foundations for modern administration and economic

development among the Yoruba and Bini, have no counterpart in the densely peopled territory of the Niger delta. The petty dynasts with their military retainers who established states in the south-east failed to establish themselves successfully in the watery jungles of the lower Niger plain, in which a host of minute self-contained settlement units have maintained their separatism down to the present time. The Ibo-speaking peoples are the largest of the linguistic groups in this area, and it is with the nature of their social structure and the problems of its adaptation to rapidly changing conditions that Dr. Meek deals in this volume.

The outstanding feature of Ibo society is the virtual absence of any stable social unit greater than a small cluster of adjacent hamlets, and the four million Ibos of to-day are divided among at least two thousand of these local groups. This condition results not from any technical backwardness of economy, for the Ibo are among the most intensive yam cultivators in Nigeria and have achieved surprising densities of population on the poor sandy soils of the lower Niger. They are also most important contributors to the supply of oil palm products which reach the coast for export. The atomism of Ibo society derives rather from the restricted and intensely localized character of their loyalties and of the supernatural beliefs which foster them. The local shrine of Ala, the female earth deity, at which the more important seasonal rites take place, is paramount in ritual, and the sacred *ọfọ* staff which the priest elder of a kin group holds as a mark of authority and ritual power is a symbol of the ancestors of that group alone. Ala shrines and *ọfọ* staffs can be multiplied indefinitely as sub-groups hive off from the main body, and a process of proliferation of small communities of real or putative patrilineal kin has gone on extensively in the recent period. The social and ceremonial independence of the separating kin groups has indeed probably accounted in large measure for the rapidity and success with which the Ibo expanded to the south and east in recent times.

But to the British authorities, accustomed to dealing with the larger and politically more coherent tribes of the east, these circumstances posed a problem whose nature and difficulty was not realized until discontent with the warrant chiefs and their courts, which bore no relation to authority and social grouping in the native societies, culminated in the riots of 1929.

The data on which Dr. Meek's study is based were largely obtained as a result of investigations undertaken after those disturbances in an endeavour to grasp the realities of Ibo society. This fully documented book indicates that the anthropological task has been achieved with a considerable measure of success, and the concluding chapter outlines and justifies the policy which has been based on it: namely, the full recognition of the present condition of social atomism, the creation of a multitude of councils and courts that correspond with the actual social groups, and the endeavour to promote cooperation between these as a foundation for organization on a wider scale in the future.

The results of a large number of anthropological reports on particular Ibo groups are analysed in considerable detail, and one of the great merits of the book is its wealth of concrete illustration of Ibo social structures. Regional variations in ritual, political and economic organization emerge, but everywhere the patrilineal lineage, usually a group of from twenty to fifty adult male kinsmen, is the fundamental nucleus. Apart from a few larger aggregations at trading centres and the exceptional intrusion of a feeble state organization based on divine kingship in Onitsha, the population is scattered over the country in small assemblages of lineages, which subdivide with increase in the size of the group and expand into new areas as opportunity affords. One of the features of theoretical importance to which more attention might have been given is the

remarkable homogeneity of culture despite the extreme particularism of social structure. Since this particularism is so marked, its very full treatment in the three chapters on "Social and political structure" could with advantage have preceded those on "The sacred sanctions," for the significance of Ibo rituals and the functions of priests are more readily appreciated after the social organization has been grasped. This is a small matter which the reader can adjust for himself, and this study, immeasurably superior to previous accounts of the Ibo, will long remain an indispensable source as well as an illuminating example of the need and opportunities for studies in applied anthropology. C. D. F.

THE VOYAGES OF CADAMOSTO, and other documents on Western Africa in the second half of the fifteenth century. Translated and edited by G. R. CRONE. (Works issued by the Hakluyt Society. Second series. No. LXXX. Issued for 1937.) *London*, 1937. 9×5½ *inches;* xlvi+160 *pages; illustrations and maps*

In spite of the long recognized importance of Cadamosto's narrative for the study of African historical geography, there has been no critical English edition of it until now. The latest publication of the Hakluyt Society supplies therefore a very real need. Mr. Crone, who undertook the task of editing the work, enjoyed the help, as he readily acknowledges in the preface, of Mr. Bovill and other experts. Supplementing the main text, which includes the narrative of Pero de Sintra's voyage, are other documents comprising our chief authorities for the course of Portuguese exploration during the second half of the fifteenth century. These are Antonio Malfante's letter written at Touat in 1447, the narrative of Diogo Gomes' voyages, and relevant extracts from Barros' 'Decades.' Their inclusion greatly enhances the reference value of the work and realizes the hope expressed by the editor that the volume might form a sequel to the Hakluyt Society's edition of Azurara's 'Chronicle.' In each case the translations have been prepared from a comparative study of the available texts and leave nothing to be desired either from the standpoint of fidelity or form. Such obscurity as still persists after translation has been effectively removed in annotations which have obviously involved much research and which illuminate the reading of almost every page. (Perhaps the following tentative suggestions for the unidentified place-names noted on p. 87 may be worth considering: Koukiya, Sokoto, Bafing, and Ikhdem, *i.e.* Agadès, for Chuchiam, Sagoto, Bofon, and Igdem respectively.)

From a critical point of view, the Introduction is particularly stimulating, not to say challenging, for on one question at least the present reviewer finds himself joining issue with the Editor. Mr. Crone is of the opinion that Fra Mauro and Benincasa were considerably indebted to Cadamosto's narrative in the compilation of their maps. His main argument, in the case of Mauro, hinges on the interpretation of a legend occurring on the Sahara about the large lips of the negroes and their silent barter of which Cadamosto speaks. In view of the fact that Italian merchants had a factory at Tunis from 1223 onwards and that first-hand European contact with the Sudan was established shortly afterwards (*vide* R. Lull: 'Blanquerna') it is difficult to believe that the facial characteristics and trading methods of the negroes would not be fairly widely known by Fra Mauro's time. A more concrete objection to the thesis arises from the fact that Cadamosto does not appear to have written his narrative until return to Venice in 1463, that is, some three years after Fra Mauro had completed his planisphere.

Concerning the Benincasa connection, Mr. Crone is even more emphatic, stating that "a comparison of the names recorded by Cadamosto with those

occurring on this chart of Benincasa's (that of 1468 which is partly reproduced in the volume) shows that the latter must have had the Venetian traveller's account before him" (p. xxxv). Now it is well known that, prior to 1467, Gratiosus Benincasa's charts (in as far as their parentage is known) were based on the Andrea Bianco chart of 1448; indeed, a comparison of the latter and the 1467 chart shows that Benincasa was either copying it or working from a common original. (There are at least twenty-eight parallel inscriptions.) It was not until 1468, that is, at least twelve years after Cadamosto's second voyage, and five years after his return to Venice, that Benincasa produced a chart incorporating the results of West African exploration down to 1462. However, the information here incorporated by Benincasa was that gained on Pero de Sintra's voyage, there being not one place-name on his later charts which could not have been obtained independently of Cadamosto. That, in point of fact, Benincasa did not work from Cadamosto's narratives appears to be evident from the following considerations: firstly, while Cadamosto's place-names are in Italian, Benincasa's are in Portuguese; secondly, there are further verbal discrepancies, not resulting from the necessities of language (thus, Cadamosto writes Gambra and Senega, whereas Benincasa writes Gambia and Cenega); thirdly, there are twice as many names on Benincasa's later charts south of Rio Grande, along the newly discovered stretch of coast, as there are in Cadamosto's narrative (33 as against 16). These additional names are obviously authentic for we find them recurring on the later portolan charts and in the *roteiros*. In the light of this and assuming for the moment that Benincasa had Cadamosto's account in front of him, it is singular that he should decide to omit two of the four place-names which the Italian navigator claims to have bestowed for the first time. The omission cannot be excused on the ground of space, for the coast-line in that particular vicinity, between Rio Gambia and Rio Grande, is only poorly served with legends on Benincasa's charts. Incidentally, the names omitted—*Rio de Sancta Anna* and *Isola de Sancte Andrea*—are not to be found in that locality on any known portolan charts of the period. Nor does this argument appear to be invalidated by the point which Mr. Crone makes (pp. xxxv–xxxvi) concerning the representation of *Arbori de Sancta Maria* at the extreme southern boundary of one of the 1468 charts. The exigencies of the shape and size of the charts (which vary) can easily be held to explain why the name is missing from the others. On examination it will be found that nearly all the Benincasa charts have a different southern terminus.

These however are but alternative points of view and, in the present state of our knowledge, cannot be pressed very far. In any case they cannot affect the permanent value of Mr. Crone's study. This, we are confident, will be welcomed equally by students of historical geography and by all who are in any way interested in the expansion of the habitable earth. G. H. T. K.

LE ROUTIER DE DOM JOAM DE CASTRO: l'exploration de la Mer Rouge par les Portugais en 1541. By A. KAMMERER. *Paris: Paul Geuthner*, 1936. 10×6½ *inches;* vi+202 *pages; illustrations and maps.* 60 *fr.*

The Portuguese *roteiro* which M. Kammerer has translated into French is one of those classics of nautical history which are more often quoted than read, in spite of the fact that an English version of it has been in existence since the compilation of Purchas' 'Pilgrims.' João de Castro, "le meilleur amiral peutêtre et le plus savant de ceux qui se sont illustrés lors des grandes découvertes," if we accept Kammerer's glowing estimate of him, was entrusted with the task of leading a naval expedition into the Red Sea against the Turks as a reprisal for their attack on Diu three years earlier in 1538. The *roteiro* was merely a by-

product of that expedition. But it is none the less valuable on that account; indeed, it has been called "a landmark in the history of nautical science" (Boxer). Certainly little seems to have escaped the author's notice; meteorological phenomena, magnetic variation, native culture, tides, currents, and even the regimen of the Nile are given his careful attention and reveal him to have been a man of unusual scientific ability. The precision of the charts accompanying the work gives them almost the quality of hydrographic charts. It is therefore to be hoped that the publication of the first critical edition will draw renewed attention to the outstanding merits of the *roteiro* and be widely read. M. Kammerer has done his task well. The translation reads easily and is liberally served with footnotes. The Introduction, though modest in size, provides a useful background, historical and scientific, to the text which follows. It is moreover more reliable than his previous work, 'Le Mer Rouge'; but he is surely mistaken in supposing that de Castro "parle . . . jamais de la longitude" (p. 18), when in his 'Roteiro de Lisboa a Goa' he asserts more than once that whatever else his observations prove, they show categorically that "magnetic deviation has no connection with *differences of meridian*" (pp. 384 *et seq.*, 1882 edition).

The volume is well illustrated. Many of the collotype plates are reproductions of the charts accompanying the British Museum manuscript (Cotton MS. Tib.D.ix) from which the editor worked. G. H. T. K.

MONUMENTA CARTOGRAPHICA AFRICAE ET AEGYPTI. By YOUSSOUF KAMAL. Tome IV. Époque des portulans suivie par l'époque des découvertes. Fasc. i; folios 1073–1177. Fasc. ii; folios 1178–1290, 1936–37. 30 × 24 *inches*

With these two parts of Tome IV of his historical geography of Africa, Prince Youssouf Kamal enters a period of wider general interest. In recent years renewed attention has been paid to the origin and development of the portolan chart, and this study must obviously be assisted by the publication of charts previously accessible in widely scattered libraries only. The comprehensiveness of his scheme also renders it possible to compare directly practically every known specimen of the fourteenth century. These two parts range from the work of Vesconte to that of Pizigano. From a comparison of the contents with the list given by Kretschmer in his 'Italienischen Portolane des Mittelalters' it appears that the following are reproduced for the first time: Vesconte's Atlases of 1311 and 1320; Perrinus Vesconte's map of 1327; and a portion of the Pizigano chart of 1367 (Jomard's reproduction was hand-drawn). To these may properly be added the chart attributed to Giovanni da Carignano, which had previously been reproduced in a reduced and rather illegible form. Further there is the eastern portion of an anonymous chart, now in the Prince's library, which is tentatively assigned to the first half of the fourteenth century. In many cases the charts are reproduced full sized.

Extracts are printed from Desimoni, on which the assignment of the Carignano map to *circa* the early years of the fourteenth century is based, and from various scholars on the much-debated question of the significance of the outline of Africa on the Medi ci Laurentian chart of 1357. In accord with his practice however the Prince does not state conclusions of his own.

Among the interesting extracts from manuscripts are several from the works of Ramon Lull, dealing with the tides of the English Channel, and the application of geometry and arithmetic to navigation. The latter passage appears to be the statement of the principle embodied in the "raxon de marteloio," the diagram which accompanies some portolans, *e.g.* Andrea Bianco's Atlas of 1436. Lull's work is contemporary with the earliest existing charts; it may be that these

were evolved to allow of the practical application of this method. Other extracts include portions of the 'Libro del Conoscimiento' with reproductions of the original drawings of flags, and the account of the pilgrimage of Mansa Musa, the ruler of Melli, whose display of wealth contributed so greatly to the renewed interest in the gold of the Sudan.

This series will greatly assist the student of African historical geography, who regards it as raw material for his own researches. G. R. C.

THE DRAMA OF MADAGASCAR. By SONIA F. HOWE. *London: Methuen & Co.*, 1938. 9×5½ *inches;* xvi+360 *pages; illustrations and maps.* 15*s*

The drama of Madagascar lies mainly in the rôle it has played in the history of Anglo-French relations. The first part of Mrs. Howe's book, abbreviated in the English edition, traces the history of the island from the time of its accidental discovery in 1500 by Diego Dias down to 1810. Lying on the route to the Indies, the island had its importance, yet most of the attempts to colonize it failed. The French first had contact with it in 1529, and it was not till towards the close of the Napoleonic era that Governor Farquhar of Mauritius contested their claims. The second part of Mrs. Howe's book deals with the gradual assertion of French rights during the nineteenth century, after an initial period of British ascendancy. In 1896 the native dynasty was dethroned by General Gallieni and Madagascar became a French colony; the Malagasy looked in vain to the English for help, they being by then, according to Mrs. Howe, more interested in Egypt. The book concludes with a brief description of the organization of the new colony by Gallieni and Lyautey. The later history of the island belongs to that of France, and the author does not deal with the repercussions of anti-clericalism on a community which had for long been nominally Christian.

The author has taken considerable pains in consulting sources of original information, both official and private, in England and France. It is hardly her fault if the resulting story is a sanguinary and not very attractive one. It seems that no one knew what to do with the island, and it was only the need to protect private interests that compelled the French Government to act. In the drama as revealed by diplomatic documents there is an air of unreality; one could wish for more information about the Malagasy themselves and what it was that attracted traders to their island.

Sir Charles Dilke was Under-Secretary for Foreign Affairs, not Foreign Minister, in 1881 (p. 249). J. P. H. M.

THE PHONETICS OF THE HOTTENTOT LANGUAGE. By D. M. BEACH. Published with the assistance of the Carnegie Corporation. *Cambridge: W. Heffer & Sons*, 1938. 10×7 *inches;* xvi+330 *pages; illustrations and sketch-map.* 21*s*

The full appreciation of so technical a book is possible only to phoneticians, but certain parts of it are open to the geographer interested in race and language, and are of great importance. Dr. Beach has studied the dialects of the Hottentot tribes of South-West Africa, East and West Griqualand, and the northern part of the Cape Province by refined phonetic methods both in the field and in the laboratory. He regards his work as a collaboration between himself and numerous native workers. He has treated Nama as the standard dialect, but has given particular attention to the dying Korana dialect on account of its philological importance. The affinities of the Hottentot language are cautiously discussed. The language itself is recorded in a phonetic script which makes the book an achievement in printing, and its tonal structure is displayed by means of a dot-dash system on the bass clef stave. The work shows how rough and corrupt the amateur record of many native languages must be. Such familiar

names as Griqualand or Namaqualand, are grammatical barbarisms to begin with, which make the arguments in favour of better spelling, *e.g.* Grikwaland, futile. "Without a great deal of training the hearing of most persons is very inaccurate and limited in scope." This should be taken to heart by all who attempt to record native names. And the chapter on the spelling of Hottentot should be read by all who have simple faith in the applicability of Roman script to the tonal languages. M. A.

AFRICAN MIRAGE: the record of a journey. By HOYNINGEN-HUENE. *London: B. T. Batsford*, 1938. 9×6 *inches; 114 pages; illustrations and route-map.* 12*s* 6*d*

The author landed in Egypt, went up the Nile to Uganda, visited Nairobi, then passed through the northern part of Belgian Congo, through French Equatorial Africa and Nigeria to Kano, and thence across the Sahara to Algeria. Apart from the Nile section the journey was by car. He seems to have travelled both by day and by night, and so great was his speed, though time indications are ignored, that verbs have had largely to be omitted from his narrative.

The hurrying photographer's staccato comments are nevertheless effective, and the pictures those of an expert. There is a full-sized photograph to every page of letterpress. Essentially vigorous and plain, this record of a rush cannot but appeal to those others who would themselves travel similarly had they the opportunity. F. W. H. M.

CENTRAL AND SOUTH AMERICA

HANDBOOK OF LATIN AMERICAN STUDIES: a guide to the material published in 1936 on anthropology, art, economics, education, folklore, geography . . . by a number of scholars. Edited by LEWIS HANKE. *Cambridge, Mass.: Harvard University Press* (*London: Oxford University Press*), 1937. 9½×6 *inches;* xvi+516 *pages.* 17*s*

The scope of the present volume of this series is sufficiently indicated by the sub-title; but it may be added that the editor's task has been so well performed that the work is invaluable to all students of Spanish and Portuguese America. It is an advance upon its predecessor of 1935 in comprehensiveness, and should prove as useful in South America as to other nations.

The method followed by the compilers of the various sections is shown by the pages devoted to geography. A brief editorial note is succeeded by a list of maps published, in whatever part of the world, during the period under consideration, whether these maps appeared in periodicals or other form. Next come condensed accounts of scientific expeditions to any part of Latin America, and a list, with succinct description, of articles and books dealing with Latin America, wherever they are published. Mexico, the Caribbean area, northern South America, southerly Spanish America and Brazil, are given separate sections. The Report on Colonial Archives in Guatemala, by R. S. Chamberlain, is a model of its kind. The typography and production are throughout worthy of the editing. L. E. J.

AUSTRALASIA AND PACIFIC

AUSTRALIA'S EMPTY SPACES. By SYDNEY UPTON. *London: George Allen and Unwin*, 1938. 8½×5½ *inches;* 288 *pages; illustrations.* 10*s* 6*d*

The main themes of this book are: that the greater part of Australia is arid and practically useless, that the aridity is spreading, that the habitable regions are so thinly occupied as to tempt a land-hungry nation to invade them, and that Australians may possibly safeguard their existence as a people by developing the communications and resources of the interior lowland between the mouth

of the Murray and the Gulf of Carpentaria. The author is an English engineer who has had considerable experience in arid and tropical countries, and has travelled far and wide in Australia. The aridity of Australia has been the background of geographical teaching for many years. Australians deplore the statements of irresponsible publicists and the credulity of the public as much as Mr. Upton does. But not even the late Sir Edgeworth David was allowed to say "desert"; he said "wilderness" instead. Land has to be as bare as Sinai for an Australian to call it a desert, which is reasonable, for the familiar is the only standard of reference the ordinary man has. The spread of aridity is a debatable question. Australian government and academic authorities have long been worried about the effects of over-grazing and deforestation, but investigations like those of F. A. Craft, for example, in the upper Murray basin, have brought no proof that the damage there is due to deforestation or to change of climate. The questions of population and defence go together. The criticism levelled against Australia seems to be that the original thousand of the First Fleet has increased only to seven million instead of seventy million. In this Australia has not done worse, relatively, than Canada or South Africa, but Australia and New Zealand are in greater possible danger. The terms on which Australia was colonized were explicit: the young country was not to be a charge on the Crown, it was to become self-supporting; and it quickly became so. The British Government has spent practically nothing on the development of Australia, and the British investing public has had excellent return for its outlay. Up to the War, there was a steady and growing stream of immigration, but the British emigrant has the choice of the whole Empire and prefers Canada or New Zealand, not because the terms are better, but because it is more like "Home." Australia has been developed by her own efforts, at her own expense, and has run heavily and unavoidably into debt in the process. Her rate of natural increase stands high in world-figures. Mr. Upton tells Australians exactly what they ought now to do, to establish their right to the country, and the scheme is an admirable one. But how are they to pay for the enormous undertaking, and will the right people go there in sufficient numbers? The land-hungry nations do not want so much to colonize as to gain access to raw materials, and all the new countries, even the United States, have abundance of land to spare. The problem of Australian security is part of the Imperial problem, and nothing will solve it but an Imperial plan. Mr. Upton insists that a plan begins with survey, and that Australia has a lot of surveying to do. M. A.

POLAR REGIONS

SOUTH LATITUDE. By F. D. OMMANNEY. *London: Longmans, Green and Co.*, 1938. 9×5½ *inches;* x+308 *pages; illustrations and sketch-maps.* 9*s* 6*d*

Since 1929 the *Discovery* Committee, acting for the Falkland Islands Government, has commissioned the *R.R.S. Discovery II* five times to make voyages in the Antarctic regions, to investigate the movements and life history of whales, and to study any associated phenomena which would add to the knowledge of this subject. In 'South latitude,' F. D. Ommanney, one of the zoologists who has worked on behalf of the *Discovery* Committee, describes in a very realistic fashion his experiences with *Discovery II* during some of her commissions.

Concerning the whales themselves, we not only accompany a whale catcher in pursuit of them but are given a vivid description of the scene on the "plan," often in the damp mists of early morning, where a combination of flensing

knives and steam winches reduce the leviathan to small portions. Living in the sub-Antarctic islands one necessarily comes into frequent contact with elephant seals, penguins, and abundant bird life. In Deception and other of the South Shetland Islands we are taken through the teeming cities of penguins, and introduced to their very queer and amusing habits, and on such journeys, too, we are made almost to shudder and duck our heads as the author describes the swift swoops of the skuas and terns which continually pester one in these regions.

In contrast to the Antarctic, one chapter is devoted to a whaling station at Durban, with the interesting picture of Zulus satisfying their craving for fighting on the carcases of whales. On returning to the Antarctic, an account is given of the routine work at sea of *Discovery II*, and a detailed description of the programme carried out at a "station." In the adventures that follow in the latter part of the book, one is apt to lose sense of proportion and think of *Discovery II* and her work as an exploratory ship, rather than as one which, during five commissions, has carried on a regular routine work during which time exciting adventures have only occasionally come her way. Unfortunately for the popular author unpleasantness and adventure are not the same thing; hence Ommanney's imagined diminution of prestige when he admits that the coldest temperature in which he has had to work was only 28 degrees of frost. Only those who have worked in both can appreciate how much greater is the discomfort and unpleasantness of working in damp, relatively mild temperatures at sea, compared with working in far more startling and colder temperatures on land.

It is in the chapters dealing with the ship at sea that one gets a true idea of her work, typified by such descriptions as those of the captain on the bridge endeavouring to keep the ship steady during the "working of a station," of George Ayres the netman, and of Marr "watching the wire with faithful vigilance, and letting the weather rage around and upon him." A little more might perhaps have been said of this particular voyage, during which the Antarctic was circumnavigated in mid-winter in gale weather; but no doubt Ommanney, himself a participant, hardly sees its distinctiveness as does the onlooker.

During *Discovery II*'s various cruises adventures have occasionally come her way, and Ommanney tells of the tense hours in the Weddell Sea when the ship, in 70 degrees south, was hemmed in by pack-ice, with fuel oil leaking from her damaged bows, and the prospect ahead of a fate similar to that which befell Shackleton's *Endurance*. In 1936 Lieutenant Hill, R.N.R., took the frail steel ship to 78 degrees south in the Ross Sea in order to rescue Lincoln Ellsworth and Hollick-Kenyon after their trans-Antarctic flight. The book concludes with an account of the experiences of a survey party of six who, owing to the failure of their motor boat, spent ten days tossing about at anchor in a wind-swept and ice-filled sea, and then when their boat had sunk, lived in an upturned "pram" waiting for their relief. In this incident, it is rather surprising to read of the long argument which six people had as to how best to kill a seal without a gun. One would have thought they would have known that in the Antarctic only a very slight blow is necessary to stun a seal.

Some travel authors are apt to think that their readers will be amused to read of incompetence in starting with water bottles empty, and forgetting the compass or paraffin for the stove. It seems a disagreeable affectation, and dangerous when the unofficial account is of official duty. We do not like to believe that a shore party was allowed to land on the Ross Barrier from *Discovery II* without any food, and including the author wearing snowshoes tied on with string (in substitute for which a handkerchief would have saved

untold pain); nor that another shore party left its tents standing, and its records and gear unguarded from elephant seals. From a scientific standpoint one would prefer to see such words as Adélie, Stefansson and Cirrus spelt correctly, and a critical reference must also be made to the author's description of the formation of shelf-ice. Land-ice sliding off the continent may play an important part in the initiation of a sheet of shelf-ice, but the main mass surely owes its origin to snow falling on to the cold and ice-strewn water, there to accumulate until by its own weight it is compressed into the consistency and density of shelf-ice, a density very different from that of the ice which comes off the land.

The author points out that the book is in no sense an official account of the *Discovery* Committee's activities, and this is probably to the reader's general advantage, as an official account would have minimized the adventures and expanded the scientific side. Instead we have a vivid account of a great and unadvertised enterprise, and the best Antarctic book since Shackleton's 'South.' A. S.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

DIE ANWENDUNG DER STEREOPHOTOGRAMMETRIE BEI DEN Alpenvereinskarten. By HANS BIERSACK. (Wiss. Arbeiten. Geod. Inst. Hannover. Nr. 11.) *Hannover: Geodätisches Institut*, 1937. 9½×7 *inches; 24 (inc. 4 plates) pages; illustrations and maps*

Biersack was Finsterwalder's colleague in the survey work done by Rickmers' Alai-Pamir Expedition in 1928. He actually started his career as a baker's apprentice and first became interested in photogrammetry when he was with Dr. Finsterwalder during the field work of the surveys in Austria. In the course of time he became very expert both in the field work and plotting of photogrammetric surveys, and his contribution to the beautiful maps published by the Deutsch-Oesterreichischer Alpenverein has been very great. He was killed last year while ski-ing in the northern Stubai Alps; actually he was combining his holiday with the checking of a newly plotted map of the district. The article which is here reprinted was originally written just before his death for an alpine journal. It is a clear, well-written account of all the steps in the production of one of the special maps which these clubs produce and of which the Gross-Glockner map is a well-known example; much of the material is of course already contained in Dr. Finsterwalder's 'Alpenvereinskartographie und die ihr dienenden Methoden' (see review, *Geogr. J.* 88 (1936) 277–9). But the present account is rather more from the severely practical point of view and contains many useful hints from a long experience of work in the mountains and at the stereoautograph. For many of us the map of Nanga Parbat will be a worthy, if anonymous, recollection of Biersack's careful enthusiasm. M. A. S.

BESTIMMUNG DES SCHWEREUNTERSCHIEDES HELSINKI-Potsdam im Jahre 1935 und Katalog der Finnischen Schwerestationen. By R. A. HIRVONEN. (Veröffentlichungen des Finnischen Geodätischen Institutes No. 24.) *Helsinki*, 1937. 9½×6½ *inches; map*

THE MEASUREMENT OF GRAVITY AT SEA. By B. C. BROWNE. Monthly Notices of the R.A.S. Geophysical Supplement. 1937 September. 10×6½ *inches*

SECOND ORDER DISTURBANCE TERMS IN PENDULUM OBSERvations at sea. By F. A. VENING MEINESZ. Koninklijke Akademie van Wetenschappen te Amsterdam. Vol. XL. No. 8. 1937. 10×7 *inches*

THE GRAVITY EXPEDITION OF H.M. SUBMARINE O.16 IN THE North Atlantic, January 11–March 16, 1937. By F. A. VENING MEINESZ. Koninklijke Akademie van Wetenschappen te Amsterdam. Vol. XL. No. 5. 1937. 10×7 *inches; illustrations and map*

THE DETERMINATION OF THE EARTH'S PLASTICITY FROM the postglacial uplift of Scandinavia; isostatic adjustment. By F. A. VENING MEINESZ. Koninklijke Akademie van Wetenschappen te Amsterdam. Vol. XL. No. 8. 1937. 10×7 *inches*

The acceleration of gravity continues, as it has done for a century or more, to hold a prominent place amongst the subjects of practical importance in geodesy and geophysics. The aspect of the subject changes from time to time. Once it was as a means of determining the ellipticity of the earth that the extensive observation of gravity was chiefly regarded. The figure or flattening so determined is believed to be to this day more accurate than that determined with so much difficulty by the measurement of geodetic arcs. Later, under the belated influence of Stokes' Theorem, the chief interest became transferred to the application of gravity determinations to derive, not the general shape of the geoid, but its irregularities. This is a natural consequence of the improvement of technique and of the great multiplication of gravity stations. Closely allied, doubtless, with this idea has been the work of F. A. Vening Meinesz in developing a successful technique of gravity observation at sea by means of pendulums. Following upon the great fields of gravity anomalies thus exposed there have come new theories of crustal movement, some of them associated with the name of Vening Meinesz himself. Lastly, and this time rather unhappily, has come the realization that all is not well in the field of practical gravity determination. This is something more than the common experience that the march of progress gradually renders obsolete some of the results obtained by earlier and no less accomplished observers.

It must have come as a shock to many readers to learn that some of the most important reference stations for gravity have for years past been attributed values of g in error by from 5 to 10 m. gal. Some other stations have been in error by even greater amounts.

This brings us to the first of the publications under review. The Finnish Geodetic Institute was, in 1935, faced with the following problem. Two independent determinations of gravity in 1930 at eight Baltic reference stations in terms of Potsdam gave values for Helsinki 5 m. gal. and 8 m. gal. higher than the hitherto accepted values. This work was part of the geodetic programme of the Baltic Geodetic Commission and the methods and equipment were modern, each observer having four bronze and four invar pendulums. It was therefore remarkable that there should be a range from +8 m. gal. (at Copenhagen) to −3 m. gal. (at Stockholm) in the differences between the results of the two observers. A determination by Professor Nörlund at the three named stations in 1934, using two of the new Holweck-Lejay elastic pendulums, gave a result in every case between those of the two observers with the classical pendulum apparatus. So much for the superiority of the old pendulum apparatus over the elastic pendulum.

Clearly yet another direct connection of Helsinki with Potsdam was required before the old value could be abandoned. This work was carried out by the Finnish State geodesists Hirvonen and Kalaja in October and November 1935, once more with four bronze and four invar pendulums. Observations were made at Helsinki both before and after those at Potsdam and the result, 981·9159 cm./sec.$^{-2}$, was close to the mean of the two determinations of 1930.

In order to give some small weight to the old accepted value 981·910 it was decided to round the new result off downwards to 981·915 cm./sec.$^{-2}$, which is now accordingly the authoritative value for Helsinki.

A subsidiary operation described in the paper is the re-connection of the Physical Laboratory, Helsinki (the national reference station), with the Astronomical Observatory at the same city. In this connection there is, once more, still an uncertainty due to the anomalous behaviour of the pendulums.

We must not take too seriously the fact that a new type of gravimetric apparatus, in this case the elastic pendulum, has apparently given better results than the classical apparatus. The latter must still serve as the control for the more rapidly functioning and more convenient gravimeters which have entered the field. At the same time recent events, by no means confined to Finland, have necessitated a more chastened attitude towards the results of pendulum observations. The fault cannot lie entirely in the materials of which the apparatus is made but is probably due largely to the fact that in trying to measure the small differences in gravity between two or more stations we apply a series of correcting terms, some of which may be many times the difference which we try to measure. Recomputation of pendulum observations on some new theory or data as to the correcting terms is too common and reflects the greatest weakness of the technique. Mr. Hirvonen's paper concludes with a useful summary of all gravity stations in Finland, based upon the new value at the national reference station. In addition to observed gravity the "free air corrected" value and the Bouguer (old or "slab" corrected only) value are given.

The second paper mentioned above strikes a somewhat similar note of caution. The determination of gravity at sea has received unprecedented advancement at the hands of Professor Vening Meinesz. It has been generally realized that the theory of the apparatus is not of the simplest, but it has been left to Mr. B. C. Browne to perform this further elegant analysis of the problem and in so doing to show that certain secondary accelerations are by no means negligible in practice. The horizontal accelerations of the boat, when added vectorially to the force of gravity, produce an apparent gravity which is too large. The vertical accelerations of the boat contribute an error of the opposite sign because the mean period of the pendulums does not quite give the mean value of g, which is inversely proportional to the square of the period.

Again, the rotations of the apparatus render unknown the direction of the resultant acceleration. Finally there is the direction of gravity itself with respect to the resultant acceleration to be determined. For their practical solution these things demand much ingenuity, for which as usual we do not look in vain to Professor Vening Meinesz.

In the third paper under review he gratefully acknowledges Mr. Browne's contribution to the subject and he shows firstly how the effect of the vertical accelerations can be approximately evaluated from existing records by means of the irregularities in the time marks. He considers that for most of his sea stations the effect does not exceed a few m. gal.; for those in the East Indian archipelago probably not 1 m. gal. On the other hand in the stormy last voyage of H.M. O.16 across the Atlantic Ocean to Washington and back great values up to 30 m. gal. occur. Mr. Browne had estimated that 12·5 m. gal. was to be expected on occasion. The real difficulty is to eliminate the horizontal accelerations. The Vening Meinesz apparatus has hitherto been provided with a damped short-period pendulum (actually a pair of pendulums of unequal period connected by a damping device independent of the rest of the apparatus) swinging in the plane at right angles to that of the main pair of pendulums. Such a pendulum maintains itself very closely in the direction of the resultant

acceleration, whose angular departure from the plane of swing of the main pendulums can thus be recorded. What is really required is a pendulum which will record the true direction of gravity. Professor Vening Meinesz has commenced experiments on a long-period pendulum, consisting of a horizontal beam with masses at its ends, designed to perform this function. Since it will record side by side with the main pendulums on the sheet, it is presumably to swing in their plane; and since no mention is made of a vertical-recording pendulum in the plane at right angles, the fore-and-aft plane of the submarine, the horizontal accelerations in this plane are evidently considered negligible. As regards the corrections for horizontal accelerations athwartships in work already done at sea the author is not quite at ease, but he hopes to get some approximate values from a theory of deep-sea waves which assigns to the water particles circular orbits falling off exponentially with depth. According to this theory, the horizontal acceleration desired would be calculable as the product of the vertical acceleration and the sine of the angle between the line of travel of the oncoming waves and the fore-and-aft line of the boat. The new light which Mr. Browne has shed on the theory of pendulum work at sea has not revealed anything very devastating to the great value of the work already accomplished, but it has led to a necessary improvement in the technique and a slight lowering of the estimated precision of the results.

The fourth paper is another of those epics of adventure in the cause of science to which we have become accustomed in reading Professor Vening Meinesz' accounts of his work. It requires some imagination to appreciate the conditions of life on a submarine in bad weather. How bad the weather was on this trip from Den Helder to Washington and back may best be told in a picturesque sentence of the author's: "One gale followed the other and the sea rose to towering wildness." The scientific equipment was as usual. Time was undoubtedly adequately determined by three chronometers in conjunction with the Bordeaux rhythmic signals. Echo soundings were taken, though these were confined to the periods of submergence because of wave disturbance at the surface. In all 93 gravity values were observed, 5 in port including 3 repetitions. Some valuable scientific conclusions will be possible when the gravity results of this latest cruise are computed. Together with the three former cruises of the author in Dutch submarines and similar cruises undertaken in the West Indies and adjoining waters by the United States Navy it amounts to a fairly complete survey of the North Atlantic Ocean. Explanations of the great fields of positive anomalies in the oceans and of how the implied mass-loads can be borne by the earth's crust are still required. Other problems which will be advanced a stage are those of the abrupt transitions from positive anomaly in the oceans, those of the tectonic histories of the Bermudas and Azores groups of islands, and that of the continuation or otherwise of the European belts of crustal folding beneath the ocean to the westward of the Iberian peninsula. The paper includes a chart showing all gravity stations observed by submarines in and around the North Atlantic Ocean, those of the Dutch cruises being connected by route lines.

In the fifth and last paper under review Vening Meinesz ventures into the field of rather nebulous theory, a venture which is however not to be discouraged because clear conceptions are not infrequently known to arise later from such studies. The point at issue arose through a four-fold difference between the estimates of the coefficient of viscosity of the earth (or rather of those layers of the earth in which movements tending to isostatic equilibrium take place), arrived at by himself in 1934 and by N. A. Haskell in 1935 by means of the data of post-glacial uplift in Scandinavia. Assuming that the rate of rise is directly proportional to the uncompensated sinkage Vening Meinesz deduces a value

$2{\cdot}76 \times 10^{-12}$ sec.$^{-1}$ for the constant (K) of proportionality, whereas Haskell's calculations give $7{\cdot}7 \times 10^{-12}$ for the same constant. It is shown that the difference between these figures and between the resulting values of viscosity is mainly due to the assumption implicit in Haskell's calculations that isostatic equilibrium is already established. This is not the case, for there is a mean isostatic gravity anomaly in the centre of the area now undergoing upheaval, which Vening Meinesz takes as −25 m. gal. but which, according to Heiskanen, is more nearly −50 m. gal. from the most recent results. From his assumed mean anomaly Vening Meinesz deduces that there is still 180 metres of upheaval to take place before equilibrium is established. This leads directly to the above-mentioned figure $2{\cdot}76 \times 10^{-12}$ sec.$^{-1}$ and so to an estimated rate of rise at the present day equal to the product of this figure and 180 metres, namely 1·57 cm./year. Here an interesting contact with another line of research occurs, for the precise levelling of Scandinavia shows that the actual rate of rise of the centre of the depressed area is 1·1 cm./year. The mean of the two is made to give an improved constant, from which it is deduced that in Scandinavia an uncompensated depression such as that left by the melting ice-cap takes about 10,000 years to become reduced to one-half of its value. The rest of the paper is devoted to a theoretical investigation of the constant K, of the resulting value of the coefficient of viscosity, including the case of viscosity varying with depth, and of the dependence of the isostatic rise on the dimensions and shape of the area concerned. H. L. P. J.

ECONOMIC AND HISTORICAL GEOGRAPHY

AN INTRODUCTION TO PHYSICAL ANTHROPOLOGY. By E. P. STIBBE. Second edition; with an appendix by W. A. M. SMART. *London: Edward Arnold & Co.*, 1938 (*first published in* 1930). $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* viii + 230 *pages; illustrations and sketch-maps.* 10*s* 6*d*

In its second edition, this valuable text-book has been revised, and contains an appendix by Dr. W. A. M. Smart on the statistical treatment of anthropometric data. Like the body of the text, this is a masterpiece of succinct presentation, for the amount of relevant information which has been condensed within the narrow limits of this small volume is amazing. Its four parts deal respectively with the comparative anatomy of the primates and the evolution of man, the principles of palaeontology and the more important types of fossil men, the characteristics and classification of living races, and the principles of anthropometry, including practical directions for making quantitative observations. There is also a short section (pp. 115–123) on palaeolithic and neolithic industries.

This very wide range of subjects is admirably treated, though the sections on race tend to over-simplify the problems. Thus in the racial map of Europe (p. 171) we find England and Scotland neatly divided by a line running approximately from Brighton to Ullapool, with Mediterraneans to the west and Nordics to the east; and the treatment of racial classification is likely to inspire unjustified optimism.

This book will be of interest primarily to the University student rather than to the general reader, who may be dismayed by the number of technical terms which are introduced, essential as these may be for the specialist. Apart from this however the book may be recommended to any one who wishes for a comprehensive introductory discussion of the problems of physical anthropology; and from this point of view it seems a pity that a work so eminently calculated to stimulate further reading should not include a bibliography; in particular,

the statistical section might well contain references to more advanced works for a fuller discussion of the meaning of constants and the briefer methods of calculating them. R. P.

HUMPHREY LHUYD'S MAPS OF ENGLAND AND OF WALES. By F. J. NORTH. (Reprinted from *Archaeologia Cambrensis*, vol. XCII, 1937.) *Cardiff: National Museum of Wales*, 1937. $9\frac{1}{2} \times 7\frac{1}{2}$ *inches; 60 pages; maps.* 1*s*

Dr. E. J. North, of the National Museum of Wales, has for the first time undertaken a detailed study of Lhuyd's maps of Wales, and of England and Wales as a whole, published by Ortelius in 1573, and his results are of some interest. The first special map of Wales to be printed, and that due to a Welshman, naturally claims particular attention. After a full account of the origin and later history of this map, he goes on to discuss its method of construction and sources. He thinks that the framework was supplied, directly or indirectly, by Ptolemy's coordinates, and explains the relative compression from north to south by Lhuyd's use of Ptolemy's underestimate of the length of a degree, as adopted by other map-makers of the time, which he somewhat strangely takes to have put it at 60 statute miles instead of $69\frac{1}{2}$. Apart from the unlikelihood of Ptolemy's rough and incorrect values having been accepted, we have no reason to suppose that in 1573 the statute mile would come into question at all, though the short mile, defined by Saxton (and later by Woutneel, whom Dr. North quotes) as one-sixtieth of a degree, may not have been greatly different. There is no doubt an undue relative extension of the map in longitude, as is not surprising in view of the difficulty of fixing longitudes at the time; but it seems unsafe to go back to Ptolemy for the ratio.

Dr. North's other conclusions seem sound. He makes the interesting suggestion that some of the errors may be due to incorrect piecing together of a sectional map. He finds that the map of Wales was mainly a compilation from various sources, and not based on an instrumental survey or even on personal knowledge of the whole country. Dealing with the general map, he brings out clearly the close relationship it shows with the two other most important pre-Saxton maps, those of Mercator and Nowell, and concludes that both (or an unknown map related to both) must have been used for the English section. The intriguing question of the unknown Englishman to whom Mercator owed his map is briefly touched upon. It can hardly have been Nowell, but there is more likelihood that Leland had at least some hand in the matter, possibly with John Dee as intermediary. The memoir is well illustrated by diagrams and photographic reproductions, some of the former showing the relation of Lhuyd's outlines to the reality. Here much must depend on a somewhat arbitrary selection of a basis of reference, both as regards the starting point and orientation adopted.

E. H.

QUESTÕES HISTORICO-COLONIAIS. By LUCIANO CORDEIRO. *Lisboa: Agência Geral das Colónias* (*Divisão de Publicações e Biblioteca*), 1935–36. Three volumes (Biblioteca Colonial Portuguesa, VII, VIII, and IX). $9 \times 6\frac{1}{2}$ *inches; vol I, 424 pages; vol. II, 314 pages; vol. III, 386 pages; illustrations and maps*

Luciano Cordeiro, the more important of whose minor writings are collected in these volumes, was one of the leading Portuguese geographers in the second half of last century. During that period the overseas territorial claims of Portugal were under frequent discussion, and Cordeiro advocated them enthusiastically but temperately. These articles are however less concerned with controversy than with the great figures of Portugal's age of expansion, and with the history of her settlements in Africa and Asia. Though research in the interval has

thrown a good deal of fresh light upon that period, the articles are still of interest to the student, if only for the original documents which are printed in full. The volumes are clearly printed, and with the addition of a number of illustrations, form a worthy memorial.

ORIENTATIONS. By RONALD STORRS. *London: Ivor Nicholson and Watson*, 1937. 10×6 *inches;* xviii+624 *pages; illustrations and map.* 21*s*

The author has certainly led a life of interest and variety, which he has recorded in an attractive and gripping manner in 'Orientations.' In his writings we discern the authority on the Near East, the friend and co-worker of men like Cromer, Gorst, Kitchener, and Lawrence. Readers of this journal will be particularly interested in the frequent references to Sir Percy Cox and of the author's close association with him after the taking of Baghdad. His description of him "for a decade the outstanding Englishman of the Gulf" will be cordially endorsed. Sir Ronald sums up Sir Percy Cox's character well in the sentence: "whom I admire more every day for his kindness, simplicity, dignity, knowledge, and intelligence." The reviewer can also second the admiring references to Miss Gertrude Bell.

Apart from Sir Ronald's lively account of his work in the Persian Gulf and Mesopotamia, the chief interest in the book lies in the periods when he was Governor of Jerusulem and of Cyprus. On his appointment to the Island of Cyprus he was greeted with an address of welcome tied up with the white and blue ribbons of Greece. It was not uncommon for cheers to be given for the King, for the Governor (Sir Ronald himself), and inconsequentially enough for "Union with Greece and the Fulfilment of the National Aspirations." The author writes with expert knowledge of the needs of Cyprus, of its value as an air port, and of its archaeological wonders. After nearly six years' service as its Governor he left to go to Northern Rhodesia, a lover of Cyprus and with a great fondness for the Cypriots. It may be wondered whether we have not neglected this island portion of the Empire, so rich in historical lore and of not yet appreciated strategical importance. 'Orientations' does not take us to Northern Rhodesia, but perhaps Sir Ronald will tell of his experiences there in another volume. The maps are adequate; the illustrations of high quality; and the book will find an honoured place on the library shelves of those interested in the Eastern Mediterranean and the Near East. H. ST. C. S.

SON OF THE MOUNTAINS: the life of an Alpine guide [Anton Oitzinger]. By JULIUS KUGY. Translated by H. E. G. TYNDALE. *London: Thomas Nelson & Sons*, 1938. 8×5½ *inches;* 198 (*incl.* xii) *pages; illustrations and sketch-map.* 7*s* 6*d*

Dr. Kugy's life of Anton Oitzinger will appeal not only to those interested in mountaineering, but to all who are attracted by the Julian Alps, about which the author is well qualified to write. He was a life-long friend of the guide. His account of Oitzinger is simple and straightforward, and throws an interesting light on the conditions of life for the peasants of Carinthia. The book is well translated and suitably illustrated.

LETTERS TO CEYLON 1814–1824: being correspondence addressed to Sir John D'Oyly. Edited by P. E. PIERIS. *Cambridge: W. Heffer & Sons*, 1938. 9×5½ *inches;* viii+156 *pages.* 10*s* 6*d*

Sir John D'Oyly was amongst the first batch of civil servants to be sent to Ceylon in 1801. He never returned to England, dying in Ceylon in 1824. He was deeply interested in all scientific matters, but he is to be remembered chiefly for his knowledge of Sinhalese and Sinhalese constitutional law. An introductory chapter, based on his own diary, describes his earlier years at

Cambridge. The letters which form the body of the book were addressed to him by his relatives in England over a period from 1814 to 1824. They are largely concerned with home news, but they reflect to some extent the life of the man to whom they were written, and to a much larger extent his amazing versatility. Dr. Pieris has provided a full equipment of notes and index.

GENERAL

REGIONALE GEOLOGIE DER ERDE. Edited by K. ANDRÉE, H. A. BROUWER und W. H. BUCHER. Band 1. Die alten Kerne. Abschnitt V. Afrika . . .; by E. HENNIG. 142 *pages*. Band 2. Palaeozoische Tafeln und Gebirge. Abschnitt II. Northwestern Europe, Caledonides; by E. B. BAILEY and O. HOLTEDAHL. 76 *pages*. Abschnitt III. Mittel- und Westeuropa; by HANS BECKER. 102 *pages*. *Leipzig: Akademische Verlagsgesellschaft*, 1938. 10×7 *inches; maps and profiles*. *M.22; M.14; M.14*

In this new regional geology, the Earth is subdivided on a strictly geological rather than geographical basis. Thus "Africa" includes Arabia, but excludes the Atlas region, which is geologically a part of Europe. It also excludes Madagascar, which seems less justifiable, as that remarkable island is left homeless, to judge from the table of contents. "North-western Europe" means approximately the British Isles, Norway, and Spitsbergen. "Middle and Western Europe" is the region between Fennoscandia and the Alpine folds.

The method of treatment of each area is tectonic-historical. Geological time being divided into eras, each of which ends in a great tectonic disturbance, the history of a region is traced for each era by the monuments which it has left. The association of what have hitherto usually been treated as independent areas makes possible a synthesis such as has rarely been attempted before. This constitutes the final chapter of each part, preceded by a very brief economic chapter.

The incorporation in the text of much that is new, both in discovery and in speculation, brings the whole work as much up to date as possible. The illustrations (maps and sections) are very clear, though often on rather too small a scale for detailed study. There is a fine large folding map, in black and white, by O. Holtedahl, of the Scandinavian Caledonian zone, on the scale of approximately 1 : 2,500,000. Altogether, these three parts sample a work of great value both for study and reference. A. M. D.

THE KINGSWAY SOCIAL GEOGRAPHIES. Edited by ERNEST YOUNG. Book I. Hunters and fishers. Book II. The herders. 128 *pages each*. *1s 6d each*. Book III. The cultivators. 160 *pages*. Book IV. Miners and manufacturers. 144 *pages*. Book V. Traders and carriers. 144 *pages*. *1s 9d each*. By P. R. RAYNER. *London: Evans Brothers*, [1937]. $7\frac{1}{2}\times5\frac{1}{2}$ *inches; illustrations and maps*

These text-books aim at covering all the economic activities of modern man. They are graded from the simpler lives of hunters and fishers to the more complex activities of traders and carriers. Some indication of the manner in which present-day methods have evolved is imparted by selecting the examples from living peoples at various stages of development, though historical origins are not altogether neglected. Thus the Hottentots and Masai herders introduce the sheep farmers of Australia and the South American ranchers. The text is not overloaded with detail and is clearly written, though with an occasional tendency to over-simplification, *e.g.* all the sheep in Tierra del Fuego do not belong to British settlers, nor are all the nomads of the Sahara Arabs. The numerous illustrations are more varied than usual.

THE MONTHLY RECORD

JOURNAL OF GEOMORPHOLOGY

The appearance of a new journal devoted exclusively to geomorphology is an event of great significance. With a few notable exceptions British geologists have regarded geomorphology as a by-product of stratigraphical or tectonic research, and little attempt has been made either to evolve a particular technique or to maintain touch with the more active development that has taken place on the continent and in America. On the other hand, though geomorphology is of fundamental importance to the geographer, there are comparatively few geographers who possess the necessary equipment or training to take on the burden of research in this field. The number of geomorphologists in any one country thus remains small, too small to cooperate for publication, and the logical recourse is to international cooperation, a solution which has excellent possibilities and promise. This is the policy of the new *Journal*: its title is printed in three languages; the names of the most distinguished geomorphologists in ten countries appear below that of the editor; the first number contains articles from America, France, and Britain, each with a summary in another language; and there are reviews and abstracts of geomorphological books and papers published in several different languages and countries.

The initiative however comes from America, and it is quite fitting that the country which has produced in such workers as Powell, Dutton, Gilbert, and Davis, some of the most distinguished pioneers in the study of landforms, should sponsor this new venture. In a salutatory preface the editors explain the objects of their *Journal* and admit their difficulties; it is their purpose "to make its pages an open forum for the discussion of all problems concerning the origin and evolution of the earth's features." Their viewpoint is unprejudiced and their taste catholic within the fairly broad field they have defined. It is to be hoped that they have over-estimated their difficulties and that geomorphologists throughout the world will make their contribution to the success of the venture.

In this first volume Chester Wentworth contributes an article on "Marine bench-forming processes" based on his researches in Oahu, Hawaii. He recognizes four processes of beach formation, but concentrates, in this paper, on one of them, namely the decomposition of rocks to the level of the water in pools above the level of the sea. This produces, on certain types of rocks (tuffs and weathered basalts) an abnormally flat bench, whose height bears no direct or constant relation to the level of the sea and may give rise to erroneous estimates of eustatic changes of sea-level. E. de Martonne contributes "Alignement et dissymétrie des reliefs dans la région parisienne." The alignment in N.W.–S.E. direction is examined and reasons are given for concluding that it is not due to undulations in the Tertiary cover, not to adjustment to structure during entrenchment, nor to consolidated lenses in the Stampian beds, but to fractures in the burrstone-shale capping of the plateau of Beauce during a general tilting of the whole plateau towards the south-west. The asymmetrical form of the cross-profiles of the secondary valleys is shown to be due, not to the earth's rotation, nor to the monoclinal structure but to the fracturing noted above, emphasized by the climatic effect of exposure to the moisture-bearing winds.

S. W. Wooldridge and D. Linton, in a paper entitled "Influence of Pliocene transgression on the geomorphology of S.E. England," demonstrate that the extent of this transgression was much greater than is generally realized, and that,

with the probable exception of a large Wealden island, it inundated the whole of south-east England south and east of a line from Bedfordshire to the Dorset coast. The shore-line of this sea, at 650 feet, and free from any subsequent warping, is traced over a wide area where it is preserved as a recognizable feature cut in the chalk hills; where such proof has been destroyed stream epigenesis is used as independent confirmatory evidence of the extent of the transgression.

These are three valuable and scholarly contributions by workers recognized as authorities each in his own field of investigation and they set a high standard for later authors to emulate. A. A. M.

CATALONIA

The problem of the relationship of the Catalonian region to the rest of Spain is no new one, and an understanding of it calls for careful appreciation of both geographical and historical factors, the former fixed and the latter constantly changing. Herr Pauser, in 'Spaniens Tor zum Mittelmeer und die katalanische Frage' ('Macht und Erde' series, Heft 9. Leipzig, Teubner), is chiefly concerned with historical matters, though he has assembled a good deal of miscellaneous information in the brief space of seventy-one pages. His underlying conception, implicit perhaps in the detailed examination of the eastern trans-Pyrenean routes, is more clearly revealed by a sketch-map (p. 68) portraying the western basin of the Mediterranean as the *mare nostrum* of a Greater Catalonia-French group of powers. In harking back to French interest in the Spanish marches in the Middle Ages for an explanation of the Catalan desire for autonomy, the author seems to be ignoring the changing historical factor. The decline of Catalonia coincided with the closing of the eastern Mediterranean to trade and the discovery of the Americas. The reopening of the Mediterranean, the failure of the centralizing forces of Castile, and the loss of the American monopoly are all factors which would explain the desire to revert to the greater independence of the Middle Ages. Such a desire, as Herr Pauser admits, has been experienced in the Basque Provinces and Valencia, as well as in Barcelona.

Less preoccupied with external and historical factors, Mr. E. H. G. Dobby, in a well-illustrated paper entitled "Catalonia: the geographical basis of its regionalism" (*Geographical Review*, April 1938), has provided a sounder basis for an understanding of the problem. After a brief consideration of the relief and climate of the region, he examines its agriculture and resources. Agriculturally, it is more or less self-sufficing, the range of its products being extensive (and in the case of oil, the quality high) but little, save wine which is used to give body to the wines of France, being produced for export. The mineral wealth is insignificant. There remains however Barcelona, a "windrose" of ways by land and sea, as Herr Pauser describes it: unique in Spain as a port of entry and in the fact that one-third of Spain's industry is concentrated round it. "Barcelona" as Mr. Dobby recognizes, "practically is Catalonia, and its economic and cultural power has been the main impulse to nationalism." Beyond a somewhat precarious supply of hydro-electrical power, and the commercial genius of its citizens, the Catalan region has been able to make little contribution towards an industrial development which is based on foreign capital, imported raw materials (the freightage on which is increased by lack of exports), and labour drawn from other parts of Spain (chiefly Murcia and Andalusia); and which depends for its existence on a highly protected market for its goods provided by the rest of Spain. Whatever therefore the political groupings of the Middle Ages, and certain linguistic affinities (though Mr. Dobby is less than fair to the vigour of the Catalan language during the nine-

teenth century) might suggest, it seems clear that Catalonia could hardly hope to find a livelihood if it were permanently divided from the rest of Spain, if its textile and metallurgical industries were forced to compete with those of France, and its port with that of Marseilles.

THE SWISS FÖHN WIND

A monograph on the Swiss föhn wind by Emil Walter constitutes number 140 of the *Neujahrsblatt* for 1938 of the Naturforschenden Gesellschaft in Zürich. It reviews the history of the theory, discusses different types of föhn with characteristic distribution of pressure accompanying each, describes the stormy föhn of 20 and 21 May 1937, and finally treats in some detail of the local circulation during föhn in the light of modern theory. The föhn wind somewhat resembles the sirocco of the southern Mediterranean in its properties, and it was formerly thought that its warmth and dryness came to the Alps from the Sahara. It was made clear however by Hann that though föhn winds frequently do come from Africa, the heat and dryness which they bring to the valleys on the northern side of the Alps are of local topographical origin, being due to dynamical heating as the air descends on the lee side of the range. Föhn is most prevalent in the central region of the Alps and three main types are recognized: cyclonic föhn with south wind when the depression is north of the Alps, cyclonic föhn with north wind when the depression is south of the Alps, and anticyclonic föhn when an anticyclone is over Switzerland.

The south föhn is the real phenomenon and occurs on some 100 days during the year, being most common in March and November, and least common in July. The north föhn, though equally frequent, is much less conspicuous, because in the first place the wind is cold in origin, and in the second place such dynamical heating as it undergoes is not very striking in the usually warm valleys on the south side of the Alps. The anticyclonic föhn is generally feeble, often being no more than a tendency to föhn-like conditions. The south föhn of 20–21 May 1937 gave very stormy weather all over Switzerland, and the heat and dryness which it brought facilitated the outbreak of many fires. Waterspouts were observed in the Lake of Lucerne during the prevalence of the gale, and considerable quantities of dust from the Sahara fell with rain and snow in various cantons. The dust appears to have given rise to beautiful sky colours.

With typical southerly föhns the front of the mountains is covered with thick clouds, the "föhn wall," which can be seen rising above the ranges and pouring through the passes, but the clouds soon disappear as the wind carries them down the slopes. As the northern valleys of the Alps are often filled with very cold air, it might be thought that the warm föhn air would blow from ridge to ridge across the intervening valleys, leaving them filled with the cold air in stable equilibrium. This difficulty in föhn theory has been investigated by Ficker, who concludes that mixing of the warm and cold air is brought about at the higher levels by turbulence, and that the warm föhn air makes its descent in a succession of gusts, not blowing steadily in the valley bottoms and rapidly melting the snow till all the cold air has been swept away.

The memoir is well illustrated with charts, diagrams, and photographs. One of the latter shows the Wetterhorn with föhn-cloud just above it, assuming much the shape of the peak itself.

THE STRUCTURE OF THE HIMALAYAS

Mr. Wadia, as a member of the Geological Survey of India, has done geological work in the Punjab and Kashmir during the last fifteen years. No other Indian scientist has had such an extensive experience of the Himalaya, and

his Presidential Address to the Section of Geology, Indian Science Congress, 1938 (Calcutta, 1938. 28 pages; profiles and map), given on the eve of his retirement from the Survey, is a fitting testimony of the work he has carried out and of his breadth of view. It summarizes the results of his own work, and of that of A. M. Heron in the Aravalli range, of Pilgrim and West (and later West alone) in the Simla region, and of Auden between Solon and Lansdowne.

After the pioneer work of Medlicott and Middlemiss in the outer Himalaya during the nineteenth century there was, except in Kashmir where Middlemiss continued his researches, a lapse of many years before detailed surveys using modern maps were begun in 1924. The state of knowledge thirty years ago was well given by Hayden in the first edition of the 'Geography and geology of the Himalaya Mountains and Tibet,' and a glance at the sections across the Himalaya in that edition, and even in the second edition published in 1934, shows the belief in the existence of blocks of mainly pre-Cambrian formations minutely crumpled and divided off by steeply inclined faults. The results of the new work that has been done are ably presented in Mr. Wadia's address, and in yet another mountainous region we now see the existence of great overthrusts, most of which can be said to have been demonstrated with certainty. The extent of movement of some of these thrust sheets may be of the order of 50 miles, and there are outliers of such sheets along the outer margin of the lower Himalaya which are thought to have their roots in the main Himalayan range. The time is yet distant before a detailed synthesis can be made of the structural elements present in the Himalaya, in a manner comparable to that achieved by Staub for the Alps, but sufficient is known to indicate that the Himalaya, though indeed complex, are simpler than the Alps in structure. Emphasis is given to the great syntaxes of Hazara-Kashmir and Assam, which are related by Wadia to irregularities in the shape of the Gondwana block of peninsular India. J. B. A.

EXPLORATION OF THE SALWEEN VALLEY

In *La Géographie* for January there is a short account of a recent journey by MM. Guibaud and Liotard up the previously unmapped portion of the valley of the Salween. The party left Tali Fou in August 1936 and crossed the Mekong at Pingpo seven days later. Then striking north-west through a mountainous tract of the Lolo country, they reached the Salween at 25° 27′ N. and ascended the right bank to Lukou. Here fresh animals were supplied by the local chief, and the journey was continued to Maliping. Owing to the difficulties of the valley beyond, they were now obliged to substitute porters in place of their animals. As the Lisu villages are constantly engaged in hostilities with their neighbours, it was necessary to change porters each day. Beyond Maliping the journey was difficult, the path along the river being broken by cliffs and gorges. They passed through the village of Lahu where the German travellers, Brunhuber and Schmitz, who had attempted to reach Tibet by this route, were murdered in January 1909 (see *Journal* 34 (1909) 608), and continued up the Salween to Latsa. This portion of the Salween valley, between 26° and 28° N. had not previously been traversed in its entirety by Europeans. As the season was unfavourable for attempting to enter Tibet they decided to winter at Batang.

In February 1937 they left Batang for Tsarong, penetrating the gorge of the Salween between Khionatong and Songtha (perhaps the Khieunaten and Senta of the Survey of India 1/M Sheet) and eventually ascended the valley to 28° 32′ N. Thence they travelled to Atuntze, where they arrived at the end of March. The return to Tali Fu was made by Khampu. The results of the

expedition include the exploration of the Salween between 26° and 28° N., and of its gorges in the Tibetan marches, and ethnological collections from the Lisu country.

AN INTRODUCTION TO REGIONAL SURVEY IN QUEENSLAND

Regional survey, more correctly styled land-utilization survey, was inspired in Queensland by the work of Professor L. D. Stamp. The Queensland Bureau of Industry became interested in its possibilities during the years of depression, when a number of youths of fair education were unable to find employment. The opportunity of organizing an experimental survey occurred in 1934, when the Government approved the construction of a dam on the Stanley river for the mitigation of floods in Brisbane, and a basis of valuation was required for the 20,000 acres of land ultimately to be submerged. Six youths were selected, and a camp was established. The boys had had no special training, they had to work on foot in difficult country as much as 5 miles from camp, and their only maps were the 20-chain parish maps which give little topographical information. In time they were able to make the finished drawings of the land-utilization survey themselves, and to assist in the engineering surveys of the district. During the course of the work many found permanent employment in one or other of the government departments and others were taken into camp, but the work was finished in two years at a cost, including wages, of 2*d.* an acre. The dam is now under construction. "The experiment," wrote the Director of the Bureau of Industry (in 'An introduction to regional survey in Queensland,' Brisbane, 1936), "has proved that a surprisingly high degree of accuracy can be achieved at a very modest cost." The map of the parishes of Bowman, Byron, and Kilcoy (Queensland Bureau of Industry, Brisbane, 1936), which covers an area of about 180 square miles, has the familiar faults of Australian state draughtsmanship and reproduction, but, short of general hypsometric information, it gives a fuller geographical picture than any other map so far published in Australia. It may be inferred from Mr. W. W. Williams' pamphlet that a policy of land-utilization survey by camps of boys has become established in Queensland. The average rate of work has been assessed as 3000 acres a week; and the system of mapping slopes has been improved. "It is common practice," says Mr. Williams, "to assume that many large estates of good agricultural quality are held in an undeveloped condition by private individuals. This is not borne out by the few investigations made. . . . Everybody is willing to declare that Australia is capable of a great many more millions of rural population; this may be so; nevertheless, the statements are founded more upon enthusiasm than upon any detailed knowledge of the facts." He sees, in the land-utilization survey of Queensland, an economical way of ascertaining the facts.

M. A.

OBITUARY

MELVILLE WILLIAM HILTON-SIMPSON

Mr. M. W. Hilton-Simpson, who died on March 17, was distinguished for his researches into the life and culture of the Berber people of Algeria. Born in 1881 he was educated at Wellington and Exeter College, where, after graduating, he obtained the diploma in anthropology. From the first, he directed his attention to the natives of Africa, making his first journey in 1903 to North Africa

and the Sahara. His next journey was as a member of the ethnographical expedition led by Mr. Emil Torday on behalf of the British Museum to the Congo in 1907–09. The area studied lay in the upper basin of the Kasai and the Sankuru rivers, and the party visited the Bushongo kingdom and traversed the unmapped country between the Kivilu and the Kasai. Mr. Hilton-Simpson later published a general account of this expedition which had resulted in the acquisition of much valuable ethnographical material, through the good relations established with the native tribes.

In 1912 Hilton-Simpson began his studies of the Algerian Berbers which were to form his chief contribution to ethnography. The region chosen for study was the Aures massif, and in the course of several winters he and his wife visited all the main valleys and larger villages. By joining in their hunting expeditions and games, he gained the confidence of the natives, then isolated from the outer world. He was thus able to study them closely, more particularly their methods of measuring time for irrigation purposes and native surgery, including the technique of trepanning. This mutual confidence also enabled him to arrange for Mr. J. A. Haeseler to take valuable films of native life and industries. His work revealed that many elements of their culture can be traced back to Roman times.

In later years Mr. Hilton-Simpson suffered increasingly from ill-health, arising partly from his war services. He had served in France until retired, as a result of wounds, with the rank of captain. The French government recognized his work in Algeria by creating him a chevalier of the Legion of Honour, and his contribution to ethnography was marked by the award of the Royal Anthropological Society's Rivers Medal in 1932. He had been a Fellow of our Society since 1905, and contributed papers on his work to the *Journal*. He is survived by his wife, Helen Dorothy, daughter of Mr. M. D. Mackenzie, whom he married in 1911, and a daughter. Mrs. Hilton-Simpson has presented to the Society, in accordance with her husband's wishes, a number of his books, negatives, and the manuscript of his traverse from the Kivilu to the Kasai.

MEETINGS: SESSION 1937–38

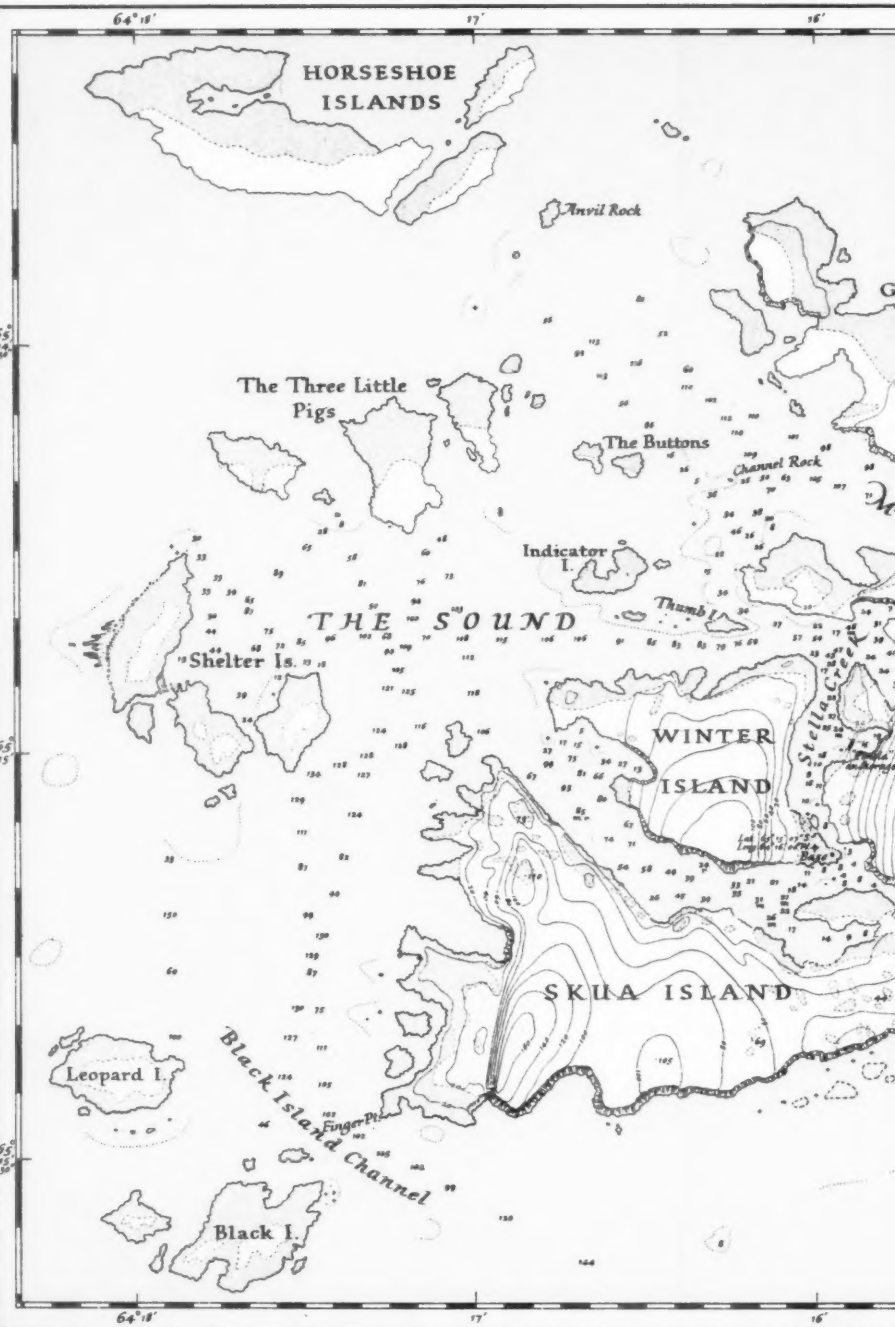
Thirteenth Evening Meeting, 9 May 1938. Professor Kenneth Mason, Deputy President, in the Chair

Elections: Ronald Fyfe Angas, B.A.; A. W. Bridge; Norman Ostle Clappison; Major Aldington George Curphey, M.C., M.D., C.M.; The Reverend C. R. Deibler; John Cragge Guy; Miss Hilda Adelina Kair, M.A., B.COM.; John Llewellyn, M.SC., F.G.S.; Major Donald George Lowndes; Desmond Francis Haslett MacBride; Albert Henry Munday, B.A., PH.D.; Edward R. Pettit; Robert Wyndham

Paper: On the frontier of British Guiana and Brazil. By Captain H. Carington Smith, R.E.

Seventh Afternoon Meeting, 16 May 1938. Professor Kenneth Mason, Deputy President, in the Chair

Paper: Discussion on the geographical distribution of industry. Opened by Professor E. G. R. Taylor



Published by the Royal Geograph

16'
64°15'
14'
URUGUAY I.
GROTTO I.
MEEK CHANNEL
CORNER ISLANDS
Corner Rock
GALINDEZ ISLAND
Stella Creek
Base
65° 14' 30"
65° 15'
65° 15' 30"
NORTHERN BASE, ARGENTINE ISLANDS
B.G.L.E. February 1935-February 1936
from surveys by A. Stephenson and Lieut. R.E.D. Ryder R.N.
Scale 1:15,000
Yards
200 0 200 400 600 800
Heights and soundings in feet
Exposed rock in late summer
The new names on the chart are those proposed by the Leader of the Expedition.